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COMPANY PROFILE
LEADING MANUFACTURER

# Interview: Tone Konda, director, and Jože Štupar, technical director

We asked director Mr. Tone Konda and technical director Mr. Jože Štupar what does it take to be a successful business global player for more than 20 years?

Two years since the last interview seems to be a good time to review events from a slightly broader perspective. What is your take on the events since then?

**TK:** First, I would like to point out that today is the 22nd anniversary of the establishment of Keko Equipment. Adding to this the years when we were part of Iskra, this is quite a beautiful tradition.

However, there are always fluctuations in our field, as well as in our company. Last year was more peaceful, and we took advantage of this to complete certain development projects. This year, however, has been much busier with regular orders. Although we are no longer so tied to Europe, we can see that the European economy is in a conjuncture.

At the moment, we have been positively drawn by the trend of the "wireless charging" of mobile phones, where a lot of investments

were made years ago. The technology is not new, but the breakthrough was made by Apple and the new market interest was adopted by other manufacturers. We build the machines for a certain level of this kind of production, which is an important application in the business sense. The plan is for wireless chargers to become a part of the public infrastructure and this is an important opportunity for us.

JŠ: Business events always come and go in waves. When we are not busy fulfilling orders, we are busy with development. There is never time to rest. But despite our full schedule, we have succeeded in making an important developmental step by laser drilling holes in foil/green ceramics. At present, we are introducing a machine that combines both the standard punching technology and the new laser drilling technology. This is an important achievement and









I hope that we will be able to present a prototype at Produtronica.

Another achievement is the manipulation of the layers in green ceramics. In addition to the existing variant, where the layers come in cassettes, we now offer a line where the layers come on trays. Trays are more appropriate for some of the more demanding structures and smaller product series than the transport of layers in cassettes.

# What are the global industrial trends that you follow in your processes?

**TK:** We can't allow the Industry 4.0 strategy to sidestep us, so we are already implementing it in our development. In particular, it is important to connect the machines into a network, to capture the data on the operation of the machines and the people who use them.

JŠ: Our first machines already had a similar technological core, but they were closed, isolated systems. Networking establishes greater control and traceability of the process. The question is, to what extent is this really used in practice - but the technology platform is set up. Sometimes, even in the field of technology, things can be a matter of fashion, and here it is necessary to be objective in order to

avoid over-engineering, which raises the costs and unnecessarily complicates the products, management and maintenance.

#### How often do you, as a small but technologically advanced company, set trends in your specialized field?

**TK:** We create complete solutions by implementing elements that appear with the development of the free market, as well as with customers and competition. Nevertheless, it has been our basic motto during these years to offer a package solution, not just a machine.

JŠ: If, together with the machine, you offer the customer materials and technological know-how, and therefore a complete solution, this is a key market advantage.

# Have copies of your machines already appeared?

JŠ: Yes, we have already noticed machines that we can claim to be copies of our own on the market. But the essence is usually hidden from the eyes. If you simply disassemble the parts of our machines, measure and reproduce them, your result will always be just a copy that does not capture the essence.

**TK:** For this reason, we can usually offer better prices than our imitators, i.e. those who copy us.

JŠ: Copying is not a serious problem, but it is necessary to closely monitor the market. Brand building is also important and we have built a good name in our strategic markets.

# Keko Equipment has been a global player from the beginning, and you are also witnessing various global processes.

**TK:** It is a necessity to focus on all the world markets; some might be more interesting than others at certain times, but we have to think about the long term. We cannot afford just one market because there are too many fluctuations. China is becoming increasingly important for us, while Russia is a little specific. In Russia, we changed the sales system, which immediately brought good results, even in the field of materials. China and Russia together currently make up close to half of our market. A market like South America would definitely be interesting for us, but for now there doesn't seem to be a need for our product in the industry.

JŠ: In some ways, the West can be shortsighted, which most Europeans do not seem to understand or be aware of. Global Western politics and the restriction of economic exchange, e.g. in Russia, has





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caused a desire for self-sufficiency. In the long term, Russia is forced to shy away from Europe and is turning to China, South Korea, Japan ... First, we globalized the world, but now we want to share again.

**TK:** Europe is extremely puritanical here. Unfortunately, European subsidies have, in many respects, turned out to be more of a social and political tool than a tool for actual economic development.

**TK:** It is necessary to have a broader perspective and to predict events as far as possible. The year 2022 - which is only 5 years from now - will close the market for new cars with an internal combustion engine. We have to ask ourselves what this could mean for us? Is it an opportunity or a threat? Obviously, electric cars are the future, even if we do not have the charger infrastructure yet.

|Š: This is actually the only real potential for the development of the



#### Recently, you have officially opened a showroom in China.

**TK:** That is correct. In China, we have been unofficially operating a showroom, which has already acquired at least 3 projects for us. Recently, we also held an official opening, which can be read about in another article.

JŠ: The Showroom is important for connecting us, our customers, and their customers and investors; it is an important and complex process that needs to be understood and assisted. Our customers can take samples and perform tests in the showroom, or bring their own customers along. Things suddenly become physical, tangible.

**TK:** We already have three showrooms around the world now, and we are planning to open a similar one in Russia, which should be followed by the production of materials.

**JŠ:** In the US, the showroom is covered by our representative in the development of applications, and in Europe, the showroom is at our factory in Slovenia in Žužemberk. At home.

# How does your global action also help the cultural understanding of the world economy?

JŠ: Desire, knowledge, healthy greed and diligence are the basic conditions for business success. Money too, of course. And a bit of luck does not hurt either. It is also necessary to understand the individual markets and individual people culturally. For example, the German way of thinking is the way to go in the industry. Personally, I am also interested in other cultures and the global frictions between them. This is important if you want to understand the market. It is not always easy.

industry in the coming years. The competition in the electrification of means of transport is open. There are many people who are unaware of all the problems in this respect; nobody knows the right solutions yet. At the moment, there is just a rough vision of feasibility and a new development cycle.

**TK:** Photovoltaics are too dependent on politics and subsidies; there is no perfect underlying logic or perspective. The majority of European subsidies for photovoltaics went to Chinese producers. They would burn coal for the production of solar cells. From these, Europeans then produced "clean" energy. The whole subject is absurd, and the photovoltaic market has also decreased drastically.

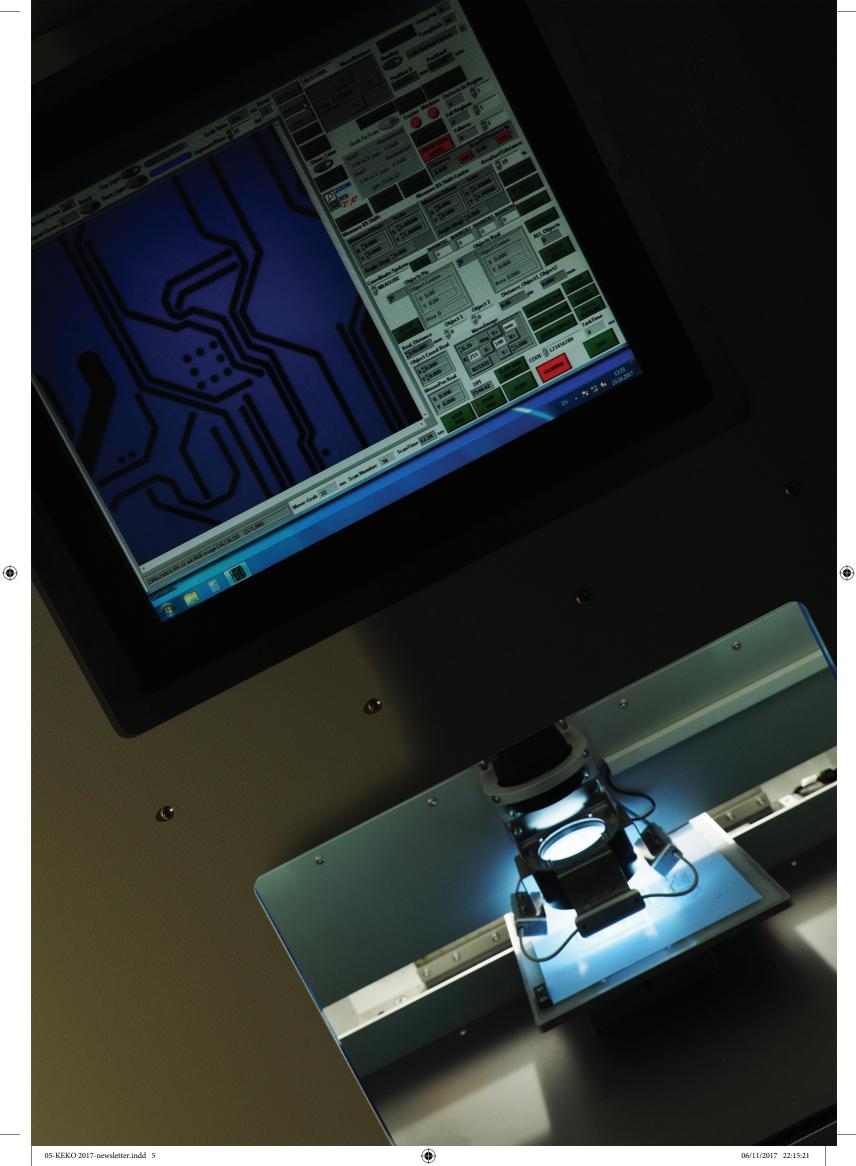
#### Your vision for the next 10 or 20 years?

JŠ: The electrification of traffic will be crucial, but it will not be unambiguous. There will be many types and we are waiting for the key element - investments in infrastructure. In our business, there is no reason for ceramics not to remain, since they have great potential and will be irreplaceable in some products. We have such a position in the market that I believe we can keep or even expand it. But you never know what could happen in the short term.

**TK:** Technology has already been developed for a bunch of things, it's just a matter of marketing - and here, the Americans are without a doubt the leader. This is partly due to their specific mentality.

JŠ: Our vision of the company is that we will remain in a similar physical position. We are a development company and we want to create added value in this segment. However, we have some independent development projects that may lead us to certain other fields of industry.





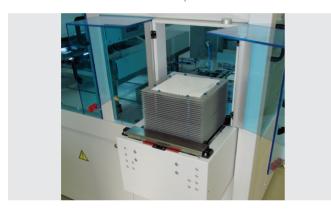
# **Newly developed**

# **Green sheets transport on trays**

... has been developed. It is optionally available for any of our automatic machine with automatic sheet handling.

# Advantage of tray transport system over cassette sheet transport are:

- tapes are separated from touching each other
- suitable for tapes without carrier film
- box driers instead of tunnel drier can be used for saving floor space at longer drying times
- easier handling for small batches and products containing many different layers
- suitable as sheet carrier in manual production too





# Next generation screen printers P-250 and P450 series



Compared to previous generation (P-200 / P-400 models), new generation has 50mm bigger printing area.

Main goal during development was to minimize operator influence to printing process. After screen and squeegees are inserted, operator calls dedicated printing program with all necessary preset parameters.

Program can be loaded also by bar code reader, reading printed code on the product. Programable all squeegee settings and squeegee head weight compensation, make these screen printers unique. Previous, many times proven models will remain on the market for a while, for price sensitive applications.





# Laser green tape processing

In the past years we tested many different laser sources in order to get enough experiences and knowledge how different lasers perform on different green ceramics. We are now confident to offer suitable laser for most green ceramic drilling and cutting. A near infra red fiber laser and high power UV laser sources are available for different ceramic processing and applications. Worldwide new invention is laser and mechanical punching combined machine, which gives opportunity using advantages of both technologies on a single machine.

Contact us for more info, or testing lasers on your material.



# Biggest isostatic press we ever made

A new isostatic press size was developed. Pressure chamber size is  $500 \times 500 \times 180$  mm and can reach a pressure of up to 10.000 PSI or 70 Mpa. Weight of press is approximately 6 tons.





# and a biggest caster we made so far

Casting machines goes bigger for big productions. Casting machine for special thick tape casting was custom designed and produced, casting width of 1.2 m, 30 m dryer length, slitting cast tape in to eight strips and winding them in to individual rolls.









# Slurry preparing

## **Roller benches BL** - series

- adjustable rotation speed and time
- adjustable to different jar sizes

#### Models:

BL-X 1, 3, 6, 8 Max. number of jars on rubber rollers

Roller bench



# **Tape** casting

# **Laboratory tape casters** L-series

- for laboratory or small production volume
- casting on PET film
- casting speed control
- gravity slurry feeding
- tape winding

CAM-L25xxxx(xxx)

TTE\_Rotating casting wheel (R) Exhaust flow meassurement (E) Slurry supply automatic (S) Ionizer device (I) Bottom heating (B)

Top heating (T)

Dryer length 2, 3, 4 (m) 25 only - max. PET film width in cm

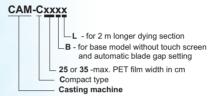
Casting machine Tape casting on polyester film

Laboratory type



# **Compact tape casters C-series**

- compact size requiring minimum floor size
- suitable for solvent and water based systems
- high accuracy in thickness control
- automatic tracking of carrier film
- automatic slurry feeding
- applicable for up to 150 micron tape thickness





# **Horizontal drying zone** tape casters **H-series**

- thickness 5-500 microns (0.2 2 mils)
- advanced drying regimes possible
- high accuracy in thickness control
- automatic tracking of carrier film
- automatic slurry feeding

#### CAM-Hxxx Drier length: 6 - 20 (m) (in 3m steps) 35, 45 or 60 - max. PET film width in cm Horizontal type Casting machine

## Steel belt tape casters **S-series**

- suitable for price sensitive applications
- diferent drying regimes
- high accuracy doctor blade
- automatic tracking of steel belt
- automatic slurry feeding
- tape winding

# CAM-S x x Drier length 5 (7, 9, 11)(m) - 30 or 60 - max, steel belt width in cm Stainless steel belt type

# **Tape** blanking

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### **Automatic green tape blanker SC-series**

- blanks single sheets from a roll of green tape
- suitable for freestanding or Mylar based tapes
- trims sheet edges
- punch registration holes (option)
- transfers blanked sheets to a magazine
- sorting blanked sheets option (Vision, thickness)

SC-35xxx T- sheet to tray, C- sheet to magazine (cassette) N - without registration punching, P- with punch too M for tape on Mylar, F for freestanding tape 35, 45, 60 - Tape width in cm Sheet cutter



# **Mechanical** punching and laser drilling

# **Punching machine PAM-series**

- punch holes for vias and registration in green tape
- punch cavity rectangle or square holes
- manual, CAD, NcDrill and DXF file input
- tool breakage detection
- automatic sheets re-alignment
- vision inspection option





# Mechanical punching and laser drilling

# Punching and laser drilling machine PLM-series

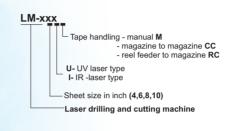
- punch or drills holes vias or registration holes in green tape, either by mechanical punching or laser drilling
- punch rectangled or squared cavities mechanically, or cuts any shape by laser
- manual, CAD, NcDrill and DXF file input
- one laser head + up to 4 punching tools possible
- vision inspection option

# PLM -xxx Tape handling - manual M - magazine to magazine CC - reel feeder to magazine RC U- UV laser type I- IR -laser type Sheet size in inch (4,6,8,10) Punching / laser combined machine



# Laser drilling and cutting LM-series

- drills vias or registration holes in green tape
- cuts any shape by laser
- CAD, NcDrill and DXF file input
- two laser types available IR-fiber or UV
- vision inspection option
- \* material testing is recommended prior laser type selection





# Screen printing

# Screen printers P - 200/400series

- Economical, production proven manual screen printers
- Programmable printing parameters
- Print/print, print/flood, flood/print, on contact print, stencil printing, via filling
- Extensive options available

# P-xxx VF or TH via filling or trough hole metalisation option S standard model A advanced model Printer size 200 or 400 Printer



# Screen printers P - 250/450series

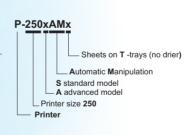
- Newly developed screen printers
- Fully programmable printing parameters, no mechanical settings needed
- Print/print, print/flood, flood/print, on contact print, stencil printing, via filling
- Printing areas up to 250x250mm or 450x450mm
- Automatic versions available

# P-xxx VF or TH via filling or trough hole metalisation option S standard model A advanced model Printer size 250 or 450 Printer



# Automatic screen printers P-series

- Automatic sheet handling, printing, drying process
- Two models available to meet al requirements
- Fully programmable printing parameters
- Print/print, print/flood, flood/print, on contact print, stencil printing, via filling and screen cleaning
- Extensive options for demanding advanced technology applications

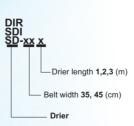




#### **Drying**

# Drier SD, SDI, DIR - series

- drying sheets, substrates, wafers, hybrids
- different designs for different purposes
- SD-type, high air flow / temperatures up to 120 deg.C
- SDI -type, for thick film pastes drying regimes
- DIR fast IR drier
- height adapted to Keko screen printers
- custom designs available





















# Standard Products Overview 2018

# Cover sheets making

# **Cover sheets maker CSM-series**

- Makes cover sheets directly onto carrying palette or paper from a roll of tape
- Glues the cover sheet to custom carrying palette
- Sheet blanker and press in one unit

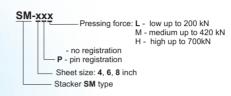
# C - cassettes for carriers Foil type: **F** - **F**reestanding **M** - **M**ylar Foil width: 25 cm max Cover Sheet Maker



# **Stacking**

### **Stacking press SM-series**

- Simplified manual stacker
- Uniaxial lamination possibility
- Registration can be done by registration pins
- High pressing force up to 70 tons
- Option: Programmable pressing curve





## **Universal stackers** SW & SWU-series

- Manual or automatic stacker for low to high volume LTCC, HTCC or other similar component production
- Suitable for tapes with or without carrier film
- Process on vacuum plate or carrier block
- Possible to start building stack from top or from
- Vacuum press for bubbling sensitive foils
- SWU type is suitable for more demanding production requirements and has more options available compare to SW type



#### **ST-series**

- Automatic sheet loading from cassettes
- Stacking on to carrier palette or vacuum
- Automatically removes carrier film first, than stacks
- Sheet pre-registration
- Automatic vision alignment
- Suitable also for very high layer count (MLCC, piezo)
- Not suitable for tapes with punched holes

### ST-xxxx P - Carrier plates auto loading C - cavity, for high stacks, without pressing possibility V - vision alignment -pin alignment Sheet loading: M - Manual A - Automatic Sheet size: 6, 8 inch Stacker ST type



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#### SB - series

- Automatic sheet loading from cassettes
- Carrier palettes automatic loading / unloading
- Pressing first than removing carrier film
- Pre-registration
- Automatic vision alignment
- Suitable for high volume production
- Suitable for various components (up to 50 layers stack), especially MLCI



# stacking

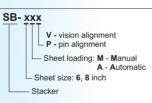
technology

# Print on stack

#### **Printing & Printing and stacking machine** PAL- xxx **PAL** - series

- Universal system for components up to 100 layers

- High productivity = low cost per component
- Suitable for smallest components size
- Uses carrier film tapes, freestanding tapes and individual sheets
- Special configurations like: -several printers
  - -several driers
  - -sheet vision alignment
  - -other special requirements



M- Mylar feeder

Sheet size: 6, 8 inch

1, 2, 3 Number of printers



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### **Laminating**

### **Uniaxial thermal press TPR**

- -Multiple stacks are laminated simultaneously
- -High stack lamination possibility
- -Simplified versions available
- -Easy to operate, quick product turn-around time
- -Rigid, compact design takes little floor space

# TPR-xxx

C- cavity for high stack lamination F- flat plates

Pressing force: L - low up to 400kN H - high up to 700 kN

-Max. bar size in inch: 4 or 6

Thermal Press

# **Isostatic lamination press**

- -Up to 40 stacks/substrates laminated simultaneously
- -Wide selection range of bar size
- -Easy to operate, quick product turn-around time
- -Rigid, compact design takes little floor space
- -Stores up to 99 pressure programs

#### ILS-xxx

D in case of double chamber length (for ILS-6 only) Max. pressure **6** for 6000PSI (42Mpa) **10** for 10000PSI (70Mpa)

Max. bar size in inch: 4 or 6 or 10 or 12 or 18

Isostatic laminator

Vacuum seeling device inclouded

#### **Cutting**

## **Cutting machine** CM

- Cuts the most difficult high thickness green Ceramic Ware
- Automatically positions knife with high accuracy
- Automatically finds cutting markers
- Adjustable speed and cutting depth
- High productivity due to high cutting speed

A - Auto bar handling from/to cassette
M- Manual machine without auto vision alignment bar size: 4. 6. 8. 10 inch

Cutting Machine



# **Edge Trimmer**

#### ET

- Simple, flexible and accurate
- Bar Edge trimming and splitting possibility
- Laser pointers installed for precise block positioning

#### ET-xx

E - edge trimming onlyA - edge trimming & bar splitting function

bar size: 4, 6, 8, 10 inch

Edge Cutter/trimmer



# **Machining** with automatic - Drills holes

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### **CNC** Milling / drilling CNC - M / D

- Cuts any shape out of green ceramic
- Automatically positions bar by vision system
- alignmet DXF file conversion
  - Vacuum bar fixing
  - Two spindle simultaneous operation option (drilling version)

## CNC -XX

Number of tools 2-for drilling machine
8-for milling machine
M- Milling machine
D- Drilling machine

Contact producer for detailed specification

# **Termination**

# **Dipping machine**

- Fully programmable dipping conditions ensures accurate and exellent termination
- Simple programming, more than 50 dipping programs can be stored
- Truth chip leveling mode ensure uniform dipping
- High speed, high accuracy servo motors positioning
- Easy cleaning features

#### **DM** - 6

- Dipping machine



#### AOI

# Vision inspection

#### **KVI**

- Designed for inspecting green ceramic sheets prints and punched holes
- Inspect wet and dry prints, via holes
- High inspection resolution
- Detects shorts, opens, neck downs, mouse bites, screen stretch screen misalignment, contamination
- Inline or offline version available



6 or 8 inspected area in inches

KEKO vision inspection



#### **Measuring**

#### **Measuring microscope**

- Travel(X, Y): 300 x300 mm Z: 120mm
- Resolution: 0.001mm Linear scales in 2-axes
- Request special catalog

For measuring prints, stencils, punched sheets and final product and many more.



# Vacuum generating

## Vacuum pump VP-series

- For vacuum supply
- Consist of: vacuum pump, reservoir, electrical control with vacuum level switch switching pump on / off, vacuum filter



Suitable to connect one to several machines requiring vacuum connection.



# Materials and Technology

Based on experiences and cooperation with institutes in field of material and technology development, Keko Equipment new strategy is offering complete solutions for multilayer ceramic products, including compatible materials, technology and machines.

Please contact Keko equipment for particular solution.

Custom desiged machines

One of Keko Equipment strongest part is custom designed equipment basted on custom requirements and our long term designing and machines production experiences.

Many customers are satisfied with our innovative solutions adapted to their needs.

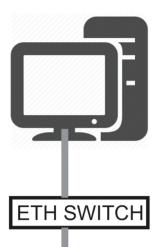
Experienced production team is guaranty for quality and success.

Contact us, if you are looking for custom solution, which you can not find on the market.

Our machines are developed, designed and produced in our facilities in Zuzemberk, Slovenia



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Keko - Equipment Ltd.

# **KEKO** view

Is newly developed software to collect process data from all KEKO machines. It enables you to have a clear overview of current machine state, parameters values and history of your batch data.

System can be implemented to all exiting KEKO machines and optionally also on other machines with minimal investment and effort.

#### Features:

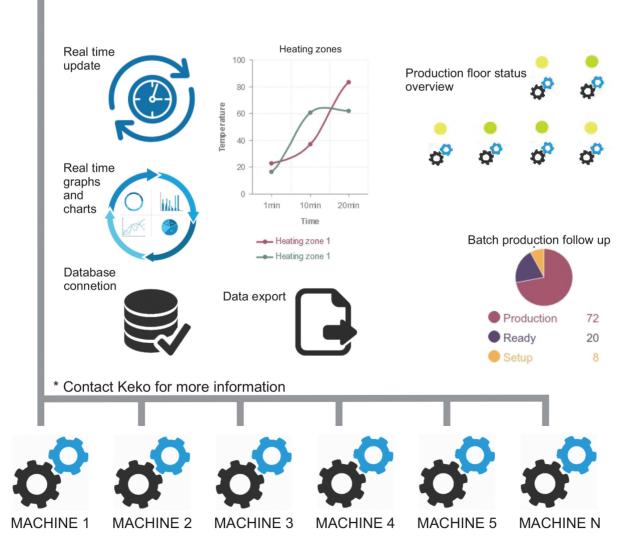
- real time data update
- production floor machine status overview
- data visualized in graphs and charts
- implementation possible on other machines\*

#### Collected data:

- Speeds, temperature, position, humidity airflow, alarms, working hours, etc.,

#### Data export

- XLS, CSV, Data base connection



# **Materials and Technologies**



# KEKO SK-47 LTCC tape



# Standard available sizes

6 x 6 inch 152.4 x 152.4 mm	8 x 8 inch 203.2 x 203.2 mm
Thickness	
254 μm	
165 μm	
115 μm	
50 μm	

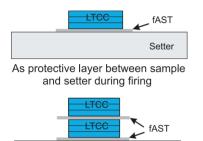






# Separation tapes

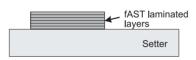
# **Applications**







As shrinkage control of LTCC and other ceramics like PZT, MNT, PLZT



As material for production high purity alumina

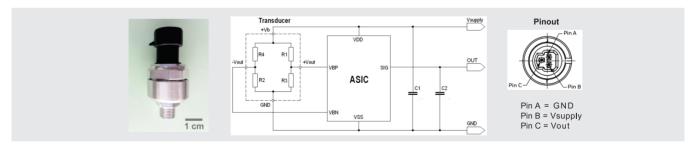


# LTCC technology application

# **Sealed-gauge Ceramic Based Pressure Sensor**

In scope of Keko Equipment business strategy to be a major global player on multilayer ceramic market, offering materials, machines and technology, we developed ceramic pressure transducers with a flexible diaphragm, very suitable for using them in a physically and/or chemically demandin genvironment.

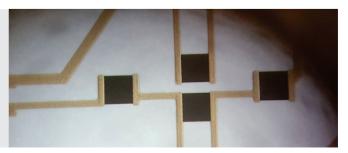
Conventional alumina-based ceramic pressure transducers, in comparison with semiconductor transducers, are larger, more robust and have a lower sensitivity. However, the use of LTCC (low-temperature co-fired ceramic) technology increases the sensitivity and offers a miniaturisation and flexible architecture with the intention to replace the silicon-based pressure sensor in some applications.



KEKO LTCC structured pressure sensors use thick-film, piezo-rezistors buried in ceramic LTCC-based diaphragm with ASIC (Application Specific Integrated Circuit) signal conditioning in aluminum housing and with electrical connector. They can be customised for variety of media and temperatures up to 400 deg. C (estimated) and for the most demanding industrial, automotive, HVAC and other applications.

KEKO Equipment is offering complete solution from materials, machines and technology development for customers, interested to this, or similar products or technology based on multilayer ceramics. Described sensor is only an example of a potential product. This development gives us new technology knowledge and consequently better custom service.







# Global presence





# Kunshan Show room opening

Keko Equipment has been present in the Chinese market for already 23 years now. We have close to 400 units of machines running in this market. By opening a "Show room" facility in China, we are initiating much better service to our existing and new customers, by giving the opportunity to test some crucial processing steps on actual machines. It is also possible to start some development of new products, without the need to invest money in very beginning. Special thanks to our partner – company PANT from Kunshan for allowing us to have this show room facility in their location.









In connection with the Chinese embassy's promotion for enlarging cooperation and trade between Slovenia and China, we were hosting the visit of Ambassador of the People's Republic of China in Slovenia - Mr. YE Hao in Zuzemberk, as one good example of how to cooperate well with China.









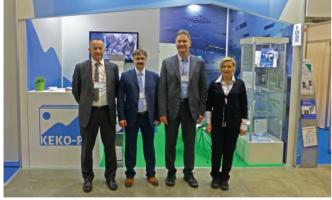
# Trade Fairs & Exhibitions

#### In 2015 - 2017 we were attending several Trade Fairs & Exhibitions:

- Productronica 2015, Munich, Germany
- Ceramics Expo 2016, Cleveland OH, USA
- IMAPS 2017 Raleigh NC, USA
- SOFC XV 2017 Hollywood FL, USA
- Strategies in Light 2017, Anaheim CA, USA
- WEEC 2016 Washington DC, USA
- EXPO 2016, Moscow, Russia
- EXPO 2017, Moscow, Russia



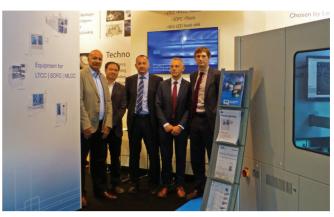
Ceramics Expo 2016, Cleveland OH, USA



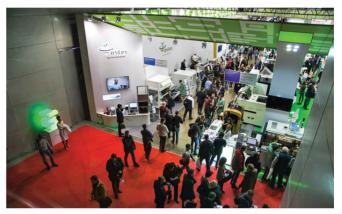
EXPO 2017, Moscow, Russia



Strategies in Light 2017, Anaheim CA, USA



Productronica 2015, Munich, Germany



EXPO 2016, Moscow, Russia



IMAPS 2017 Raleigh NC, USA



SOFC XV 2017 Hollywood FL, USA



# KEKO EQUIPMENT KEKO EQUIPMENT

# **COMPANY PROFILE**

KEKO Equipment Ltd. is a leader in the manufacture of machines for the production of multilayer passive ceramic components but also many other products, based on a tape

Thirty-five years of experience have given us the vast knowledge that is now marketed under our own brand in the European, Asian, American and Australian markets.

Our roots stretch a long way back to when we were a unit of the Iskra consortium. Since 1995 the company is in private hands and its philosophy today is formulated by a team of highly motivated

In addition to the extensive range of proven products, we focus our specialized know-how into custom manufacturing.

In the development of specialized technological solutions we take into account our customers requirements and the needs of each individual buyer, thus providing the basis for a successful long-term relationship. This is aided by our widespread sales network that spans all continents,

where we always cooperate closely with knowledgeable local agents. They have helped us to provide very successful post-sales services and ensure customer satisfaction.

Knowledge, flexibility and innovation are our company's key competitive advantages and our brand name's good reputation now reaches all over the world.

