



10 June 2021
Virtual, Germany

KET4CleanProduction - Final
Conference 2021

Developing a new clean manufacturing process for ceramic pressure sensors

Dr. Kostja Makarovič

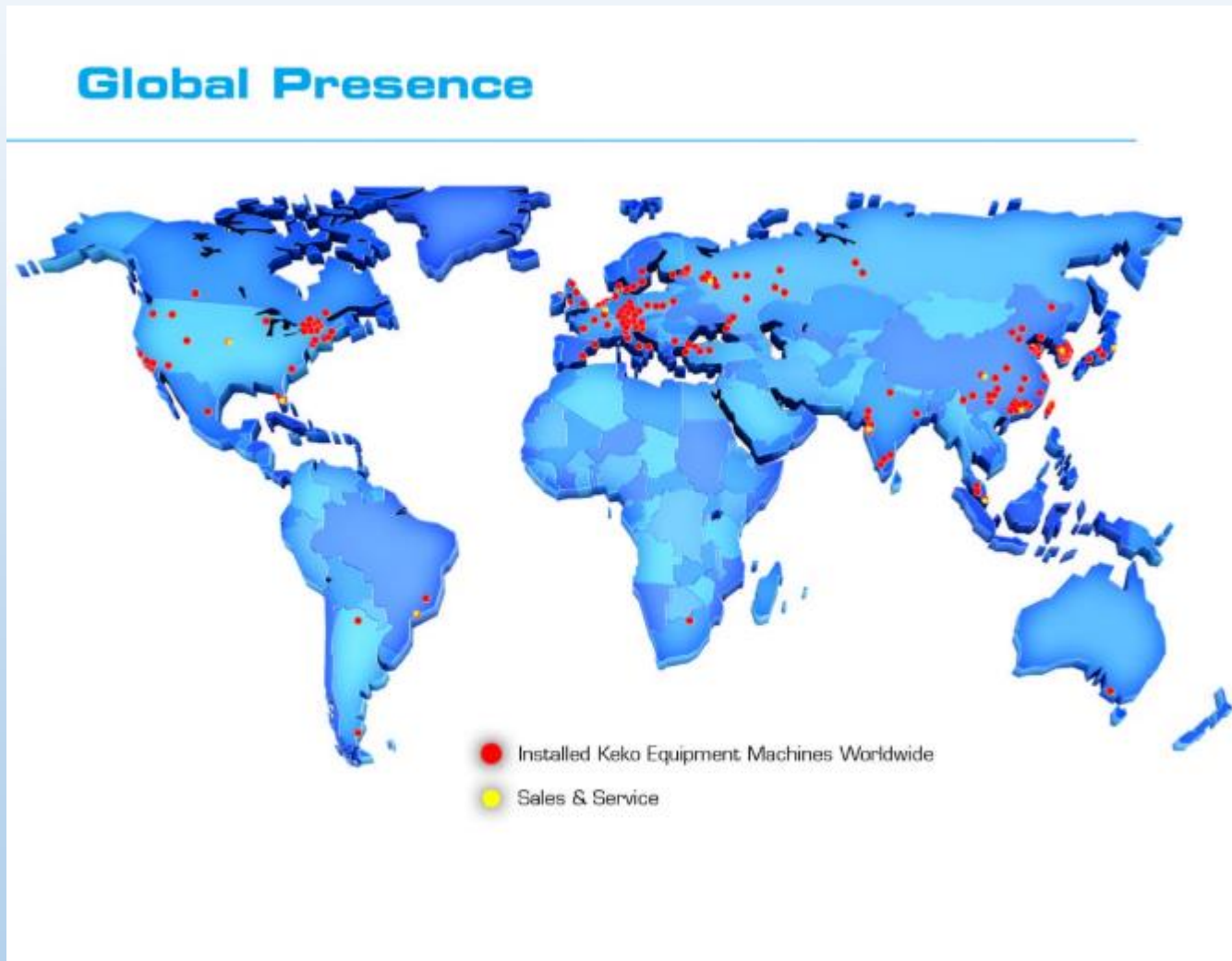
Keko Equipment Ltd, Žužemberk, Slovenia

Introduction of the company

KEKO Equipment company



The world-leading manufacturer of machines for the production of multilayer passive ceramic components, and also many other products, based on a tape casting process.



Almost unknown in Slovenia, but present all over the world!

KEKO Equipment company

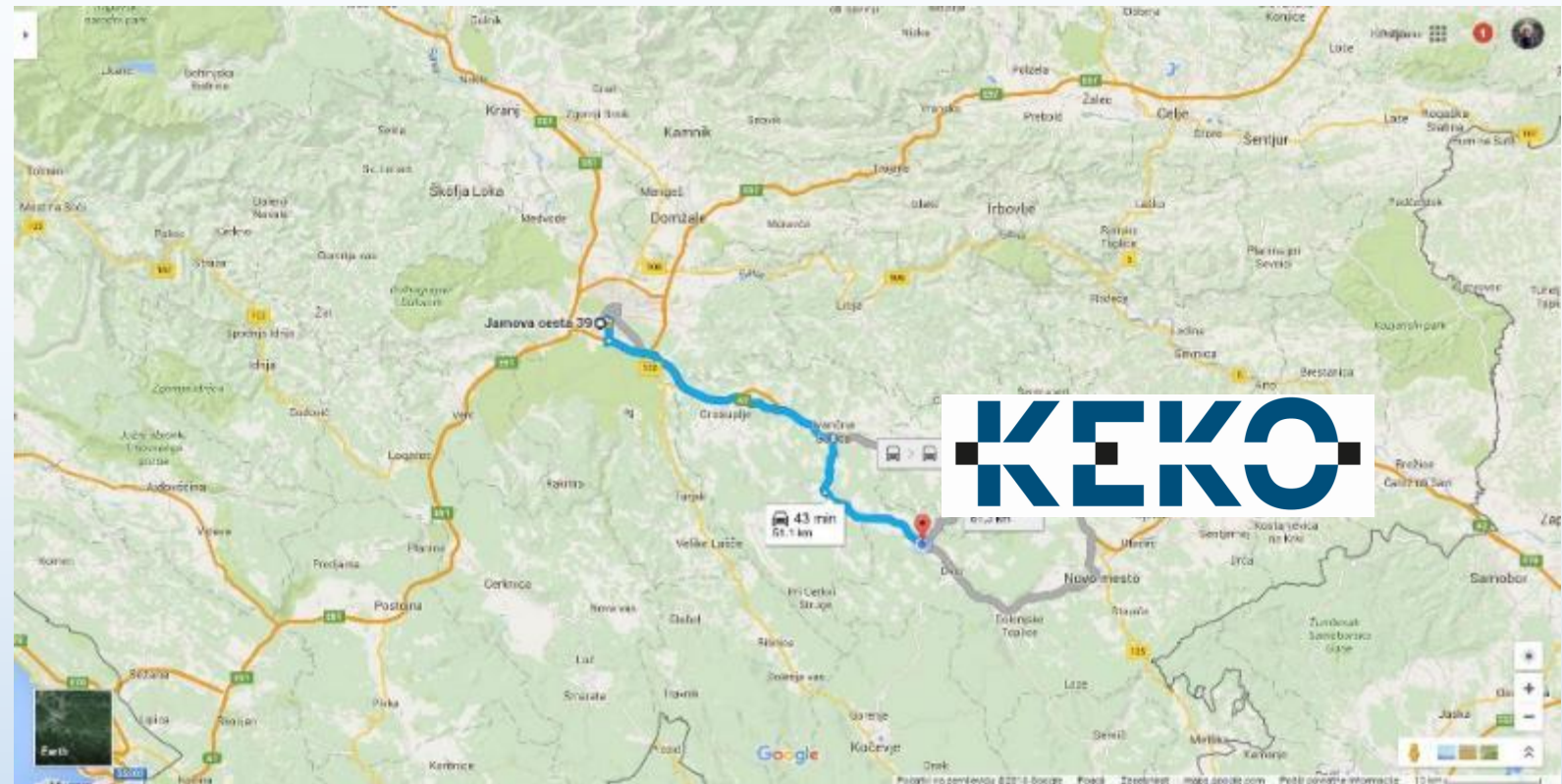
Establishment: 1995

Location: Žužemberk

50 km southeast from Ljubljana

Employees: 62

Engineers: 19



КЕКО

25

Facilities



Workshop – cutting, drilling, welding, milling



Assembly workshop



Machines before shipping

Testing facilities and showroom also available to customers



Showroom and testing facilities



Products



Roller benches



Tape casting machine



Green sheet blanker



Puncher



Screen printers



Isostatic press



Cutting machine



Visual inspection machine



Complex multipurpose custom made machines –
printing and stacking machine

What needs did you have? Why and how did you contact KET4CP?




Materials



Available machines



 Institut
"Jožef Stefan"
Ljubljana, Slovenija
Well established
collaboration



Good idea

(Introduction the LTCC technology for the production of products attractive for the global sensor market.)

**KET4CP to
connect**

How was your Microgrant project?
How was your collaboration with the TCs?

- Microgrant proposal was written in collaboration with all participants effortlessly.
- All partners did their job as described in the project proposal.
- Unfortunately, we have meetings with our partners from Germany only via virtual conferences.

What were the results of the collaboration?

Mixing raw materials



Casting & drying



Firing at 1600 °C



Refiring (3x) 850 °C



Conventional technology

1. Single firing only
2. Firing at lower temperatures and shorter time
3. Lower energy consumption
4. Possible miniaturisation lead to lower material consumption
5. Easier to establish large volume production
6. Lower costs

Mixing raw materials

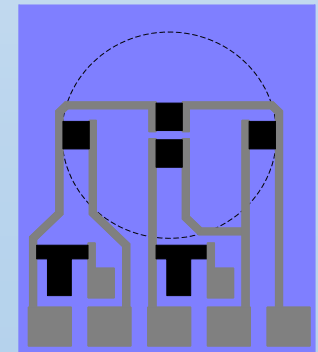


Casting & drying



Collating, pressing, printing and cutting

Co-firing at 850 °C

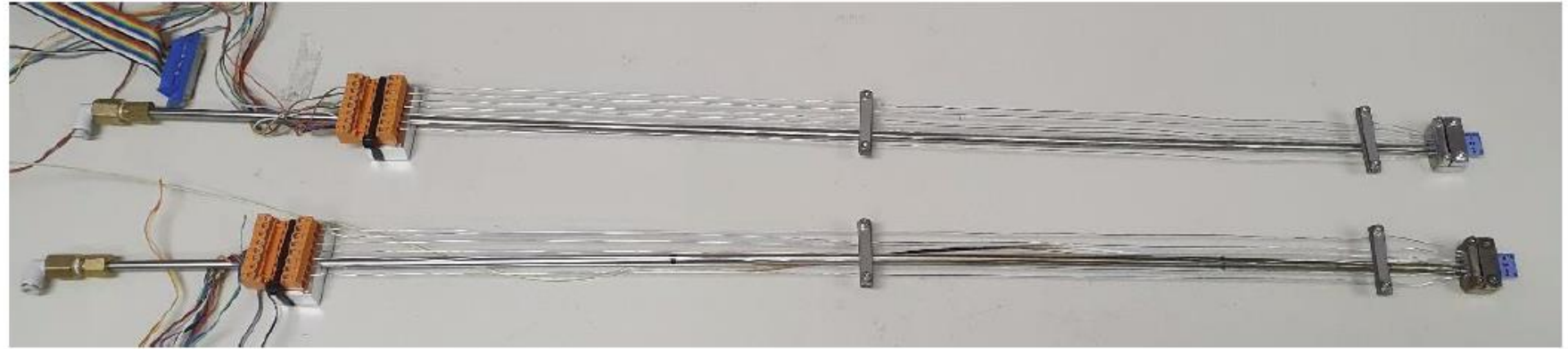


LTCC technology

What were the results of the collaboration?

Clamp for sensor

Clamp for wires

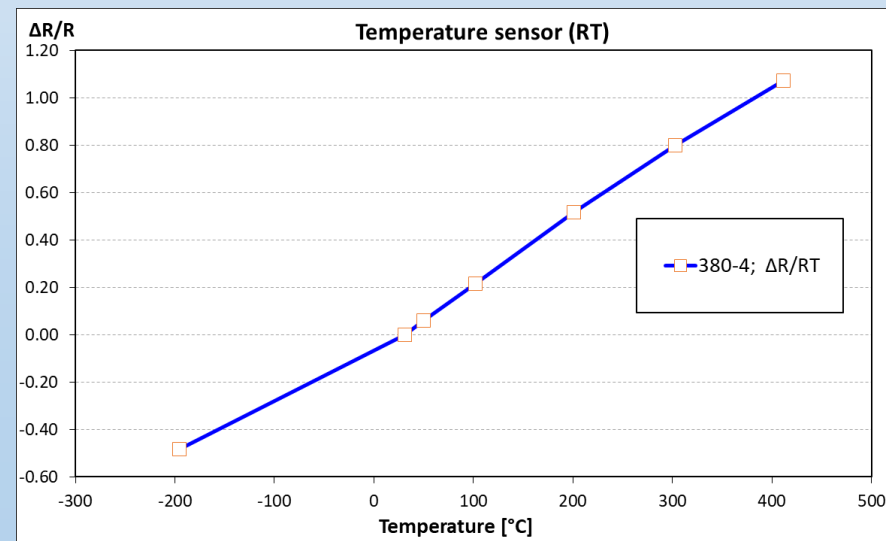
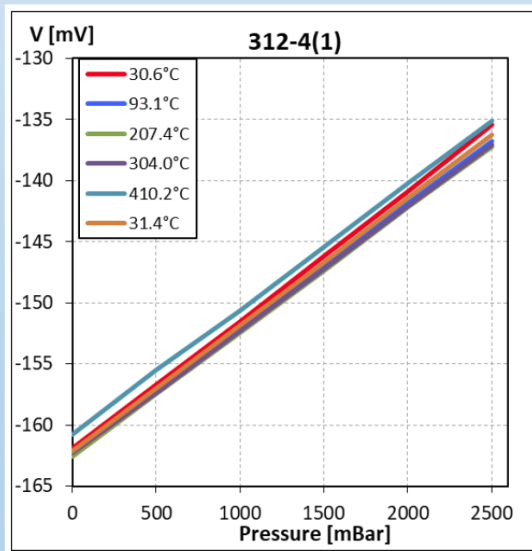
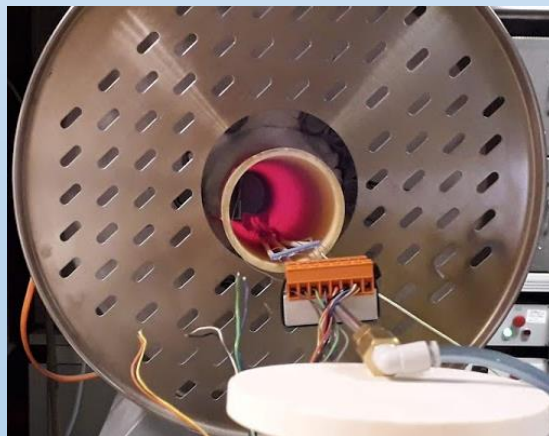


Sensor assembled in the Holder

Two holders

High temperature testing of the pressure sensors

Low temperature testing of the pressure sensors



What are your final thoughts and conclusions?

Why we like KET4 project

- Small amount of bureaucracy
- Productivity driven calls
- Good support

What we don't like

- It could be longer projects.