



MOX resistive microsensors for low concentration methane detection

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SAMPLE SYNTHESIS:



List of prepared samples :

Sensor abbreviation*	Sensitive film	Transducer (IDE/wafer)
S3	CuO	Au / Al ₂ O ₃
S4	CuO	Pt / Al ₂ O ₃
S5	CoO	Pt / Al ₂ O ₃

Sample precursors:

- $\text{Cu}(\text{CO}_3)_2\text{Cu}(\text{OH})_2$ for CuO
- $\text{Co}(\text{CO}_3)\text{Co}(\text{OH})_2$ for CoO

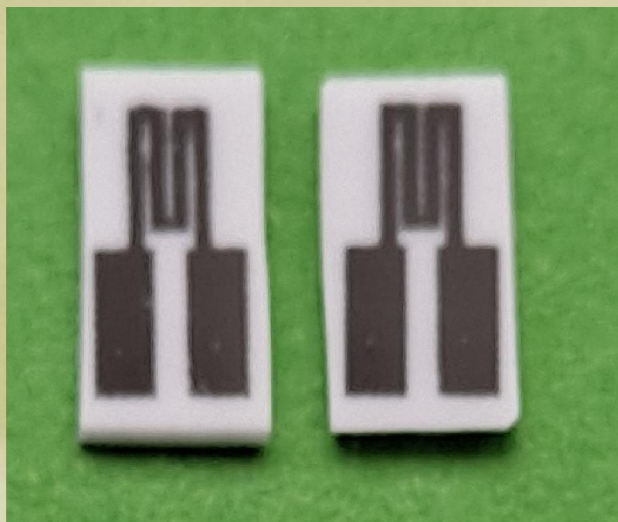
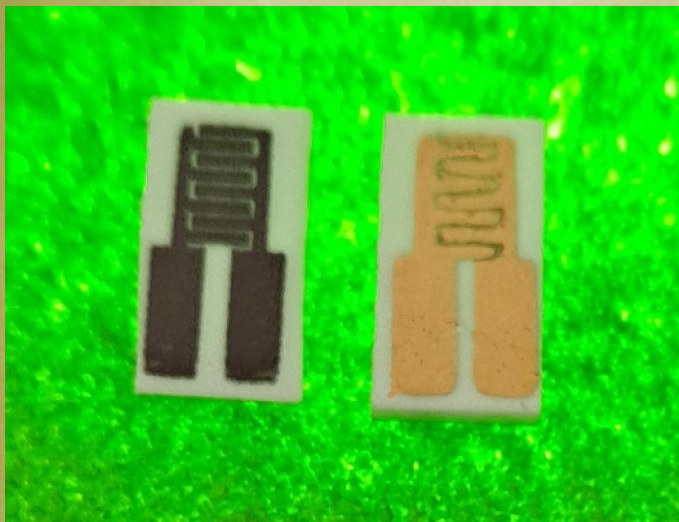
Synthesis method:

- sol-gel / spin-coating



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NANOM MEMS sensors: IDE/HEATER/SENSOR sample



Dimensions: 5 x 10 x 0.6 mm



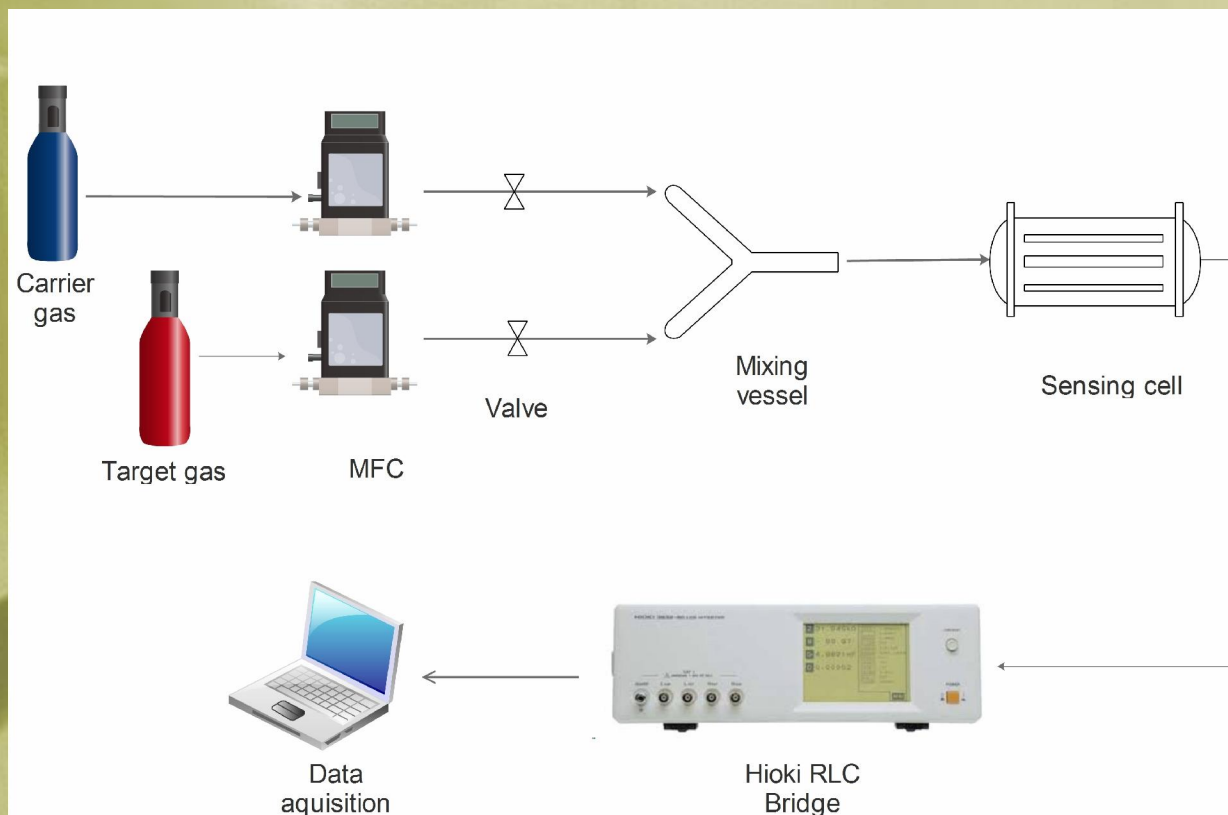
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P2

sensors



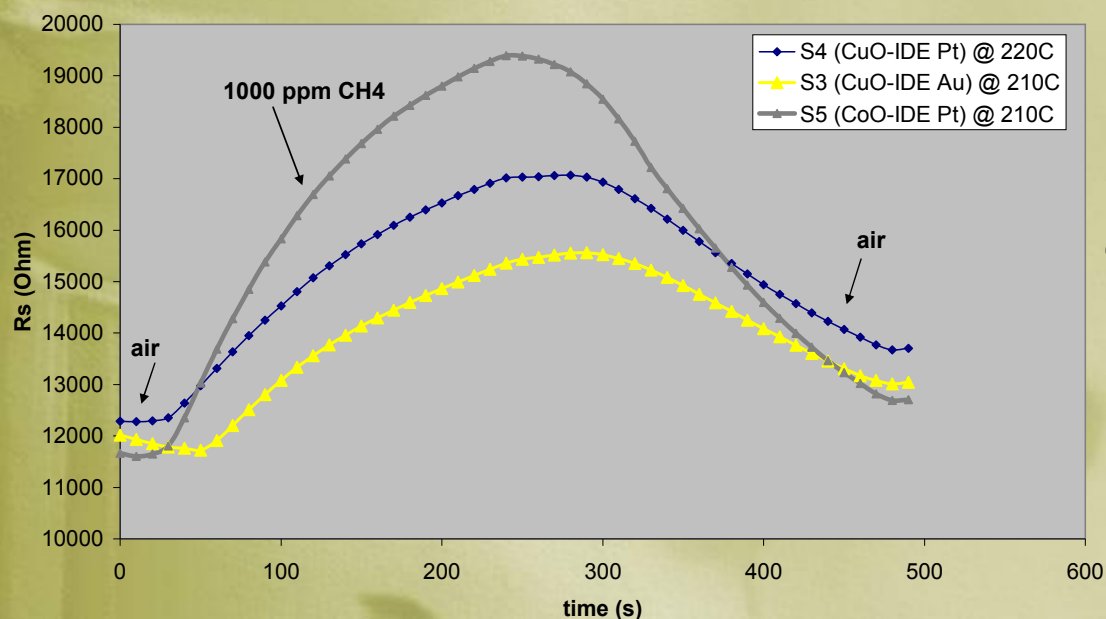
GAS SENSING EXPERIMENTAL SETUP:



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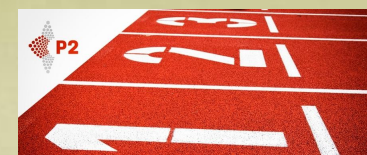


PRELIMINARY RESULTS:



The response/recovery of the tested sensors, for 1000 ppm CH_4 , at T_w specific to the investigated sensors (210-220°C)

- S4 sensor has a slightly higher working temperature - T_w (220 °C, comparing with 210 °C for the other two sensors-S3 and S5)
- Sensor responses are comparable, when using different noble metals such as Pt or Au as IDE (S4, S3)
- **Cobalt** based sensor-**S5** seems to be performing slightly better than the copper based sensors -S3, S4.
- The response of the sensors is fast (250 seconds) and their recovery is complete (250 seconds) → resume the sensing experiments, without sensor replacement
- The tested concentration of 1000 ppm CH_4 in air represents the NIOSH maximum allowed limit, for an exposure time of 8 hours, at the workplace



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CONCLUSIONS:

- Sensors with CuO and CoO sensitive films have been prepared via an eco-friendly low-cost technique (sol-gel) and tested for methane detection.
- Preliminary test results showed that the obtained sensors have successfully detected methane, with a fast response (250 s) and a full recovery (250 s).
- The tested concentration of 1000 ppm CH₄ in air represents the NIOSH maximum allowed limit, for an exposure time of 8 hours, at the workplace.
- Based on the reported preliminary results we can conclude that the obtained sensors are promising candidates for a new MOX-based methane detection resistive sensor (MOX chemiresistor).

AUTHOR CONTRIBUTIONS:

- conceptualization, M.Gh. and P.C.;
- methodology, P.C. and C.H.;
- software, P.C and C.H.;
- validation, P.C. ;
- formal analysis, P.C.;
- investigation, P.C. and C.H.;
- resources, M.Gh.;
- data curation, writing—original draft preparation, writing—review and editing, visualization, P.C.;
- supervision, project administration, funding acquisition, M.G.

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