DOI: 10.1016/j.snb.2018.12.005

Supplementary Information

Highly selective surface acoustic wave e-nose implemented by laser direct writing

Massimiliano Benetti[1], Domenico Cannatà[1], Enrico Verona[2], Alexandra Palla Papavlu[3], Valentina Carmen Dinca[3], Thomas Lippert[4,5], Maria Dinescu[3], and Fabio Di Pietrantonio[1]

[1] Institute for Microelectronics and Microsystems, Italian National Research Council, Via del Fosso del Cavaliere 100, 00133 Rome, Italy

[2] Institute for Photonics and Nanotechnologies, Italian National Research Council, Via del Cineto Romano 42, 00156 Rome, Italy

[3] National Institute for Lasers, Plasma, and Radiation Physics, 409 Atomistilor, PO Box MG 16, Zip RO 077125, Magurele, Romania

[4] Paul Scherrer Institut, Research with Neutrons and Muons Division, 5232 Villigen PSI, Switzerland

[5] ETH Zürich, Department of Chemistry and Applied Biosciences, Laboratory of Inorganic Chemistry, Zürich, Switzerland

Fourier transform infrared spectroscopy (FTIR) was applied to study the characteristic vibrations of functional groups in the MAPLE deposited thin films. The FTIR measurements of HPMC and PScMA-me polymers were carried out with a Jasco FT/IR-6300 type A spectrometer in the range 600 – 4200 cm^{-1}. All spectra were obtained by absorption measurements, accumulating 128 scans, and CO_2/H_2O correction.

The acquired spectra of both polymers, shown in Fig. SI1 and SI2 are similar to those reported for HPMC and PScMA-me in [1-3].

In particular, the peak at 1053 cm^{-1} in the HPMC spectra represents the out-of-phase vibrations associated with an alkyl substituted cyclic ring containing ether linkages. The peak at 944 cm^{-1} represents the in-phase vibrations from ether linkages and appears as a weaker band attached to the band at 1053 cm^{-1} [1, 2]. In addition, the peaks at 1378 cm^{-1} and 1458 cm^{-1} are methyl C–H vibrations,

DOI: 10.1016/j.snb.2018.12.005

while the peaks at 2835 cm^{-1} and 2898 cm^{-1} represent the absorptions of C–H vibration modes from methyl groups.

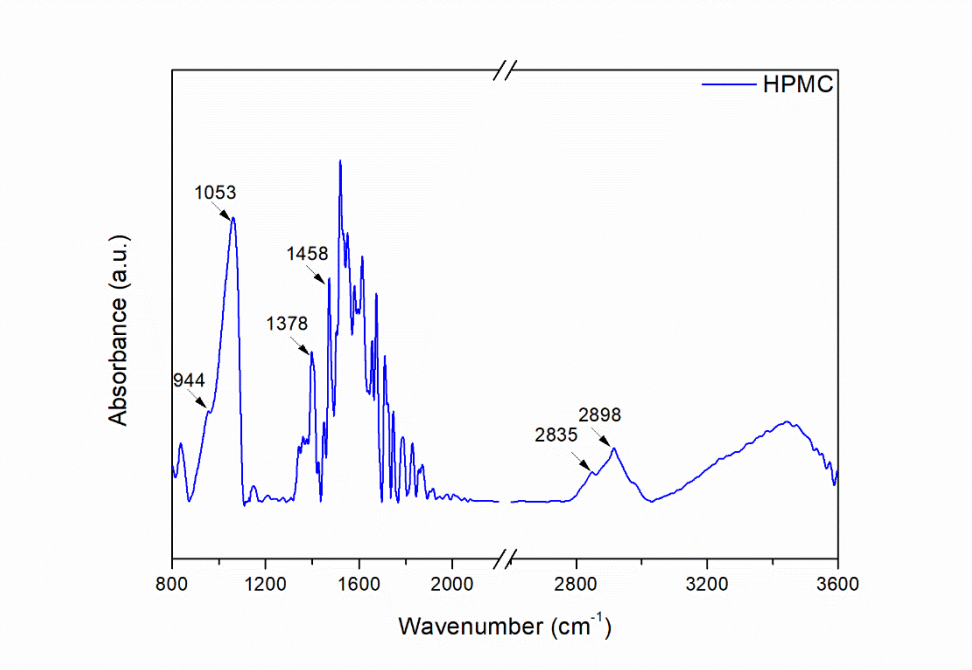

FIG. SI1 FT-IR spectra of the HPMC polymer film deposited by MAPLE at a laser fluence of 400 $mJ/cm^{2.}$

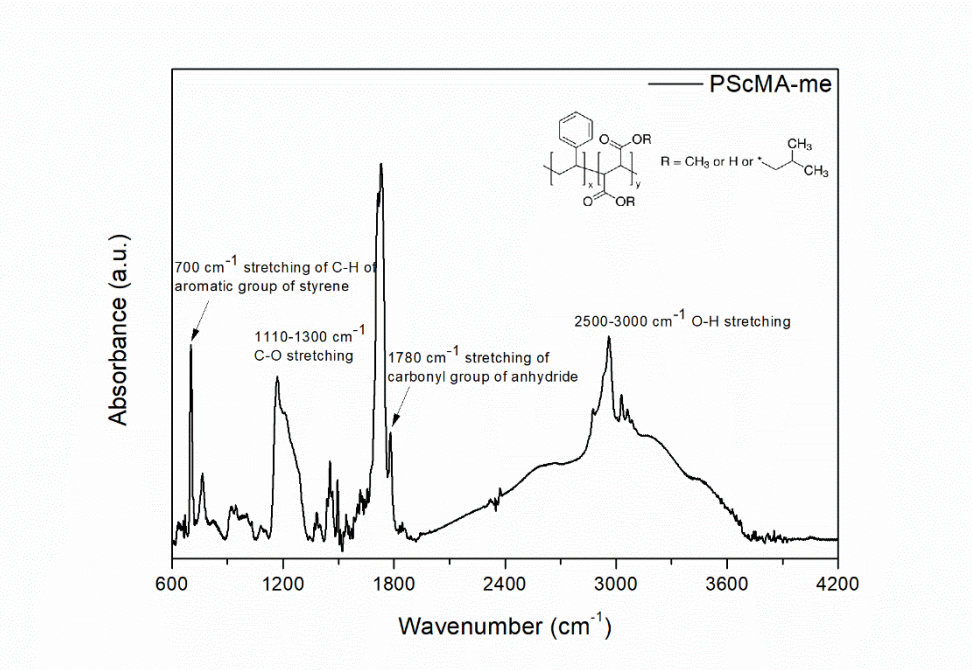

FIG. SI2 FT-IR spectra of the PScMA-me polymer film deposited by MAPLE at a laser fluence of 250 mJ/cm^{2}.

DOI: 10.1016/j.snb.2018.12.005

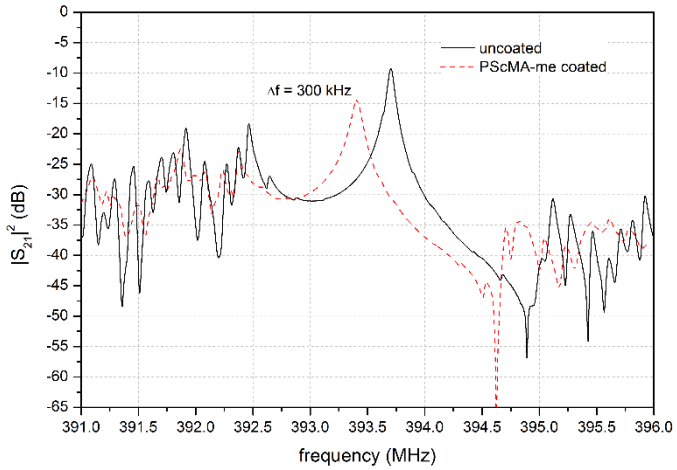

FIG. SI3 Frequency response of the SAW resonator (amplitude of S_{21}) before (continuous line) and after (dotted line) the coating with 15 nm thick PScMA-me film. The frequency shift is proportional to the polymer thickness.

DOI: 10.1016/j.snb.2018.12.005

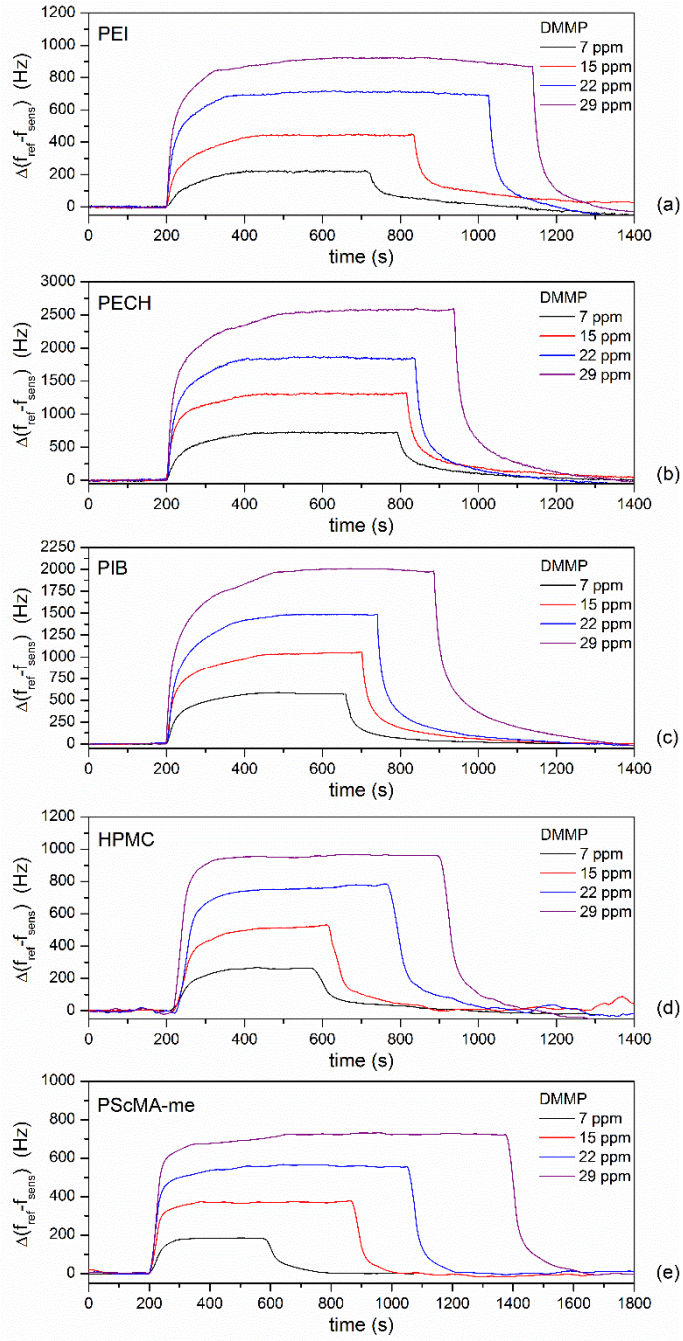

FIG. SI4 Frequency response vs. time to DMMP vapor of the SAW sensors in the range concentration of 7 – 29 ppm: (a) PEI coated sensor; (b) PECH coated sensor; (c) PIB coated sensor; (d) HPMC coated sensor; (e) PScMA-me coated sensor. The response is the difference between the reference and the coated devices frequency shifts.

DOI: 10.1016/j.snb.2018.12.005

Reference

[1] N.K. Anuar, W.T. Wui, D.K. Ghodgaonkar, M.N. Taib, Characterization of hydroxypropylmethylcellulose films using microwave non-destructive testing technique, Journal of Pharmaceutical and Biomedical Analysis, 43(2007) 549-57.

[2] M. Larsson, A. Viridén, M. Stading, A. Larsson, The influence of HPMC substitution pattern on solid-state properties, Carbohydrate Polymers, 82(2010) 1074-81.

[3] J. Coates, Interpretation of Infrared Spectra, A Practical Approach, Encyclopedia of Analytical Chemistry, John Wiley & Sons, Ltd2006.