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Acoustic characterization of thin polymer layers for Love mode surface acoustic waveguide

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We investigate the use of thin (1-10 um) polymer films as guiding layer for Love mode surface acoustic wave sensors. Beyond the great gravimetric sensitivity provided by the polymer guiding layer resulting from the low acoustic velocity, the use of photoresists provide ecnonomical means of depositing guiding layers of optimal thicknesses compared to inorganic layer deposition processes (typically PECVD deposition of silicon dioxide lasting several hours). The limit of very thick (> 100 um) layers provides means of propagating interface waves mostly insensitive to the environment (package-less sensors) whose properties only vary through modification of the bulk properties of the polymer.
We here analyse the evolution of the properties of the guiding layer in terms of acoustic velocity and losses as a function of time (solvent evaporation following photoresist spin coating) and temperature (typical baking steps). The polymer films is deposited on AT-cut quartz patterned with interdigtated transducers for generating 40 um-wavelength shear waves converted to a guided Love mode in a delay line configuration.
We complete the experimental results with data interpretation using a model of acoustic wave propagation yielding quantitative results including viscosity and density out of the velocity and insertion loss measurements, both for the guided Love mode and interface layers