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Dariusz Jarzabek

Polish Academy of Sciences, djarz@ippt.pan.pl

Wojciech Dera

Warsaw University of Technology

Zygmunt Rymuza

Warsaw University of Technology

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The measurement of viscosity of ultrathin polymer films.

Dariusz M. Jarzabek^{1*}, Wojciech Dera², Zygmunt Rymuza²

¹ Institute of Fundamental Technological Research, Polish Academy of Sciences, Warsaw, Poland

² Institute of Micromechanics and Photonics, Warsaw University of Technology, Warsaw, Poland

[*djarz@ippt.pan.pl](mailto:djarz@ippt.pan.pl)

Viscosity is a very important property of thin polymer films used in modern microelectronic technology i.e. in nanoimprint lithography. Hence, in this work we present a method for viscosity of ultrathin polymer films determination. The viscosity is evaluated from the response of the oscillating piezoelectric cantilever at the end of which an indentation probe is mounted (Fig. 1a). When a polymer film is indented, the resonant frequency of the oscillations is changed and the parameters of used model (i.e. Maxwell model) can be identified. The frequency of the oscillations is equal to tens of kilohertz therefore the influence of extremely high deformation velocities can be investigated by means of this method. It is also possible to conduct the experiments in elevated temperature (up to 150°C). The oscillations direction can be parallel as well as perpendicular to the film's surface.

The investigated films were made of PMMA. Their thickness ranges from a few nanometers up to 1 micrometer. The results were compared with other methods of the viscosity determination: the investigation of the creep response during nanoindentation, sinus mode nanoindentation and atomic force microscope based technique.

