

The use of automated afm for studying of polymers

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Automated AFM has a wide range of applications in polymer science and industry. One of the most obvious fields of application for such device is Combinatorial Material Research [1], where measurements and characterization of the hundreds samples are necessary. The most important features of AFM, which are used for automatic measurements, are: possibility to measure height of objects; wide range of methods that give additional information about surface properties; combination of the high resolution AFM and optical microscope (Fig.1). In this paper several examples of the use of automated AFM for different categories of polymeric samples are presented. These examples show results obtained for real industrial projects. Modified SPM SOLVER P7LS (NT-MDT, Russia) was used for this work.

Sample 1. Coating technology: large polycarbonate substrate, particularly covered by a protective layer. The influence of scratching on surface parameters has been studied by automated AFM. After scratching surface of the sample has been measured in several different places on covered and uncovered polycarbonate (Fig.1).

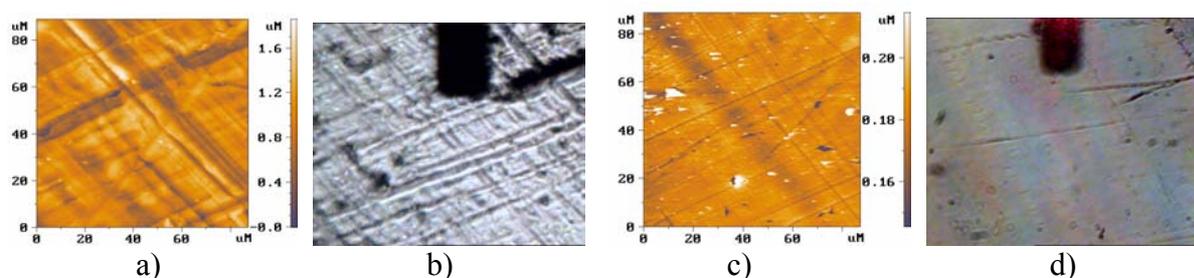


Fig.1. a,c – AFM topography of scratched polycarbonate and protective layer, respectively; b,d – corresponding optical images.

Sample 2. Combinatorial Material Research: carbon black (CB) – silicone rubber composite. The sample consisting of droplets of this composite with various concentration of CB and different time of curing has been measured in order to get information about surface concentration of CB (Fig.2). 20 droplets were measured automatically for this sample.

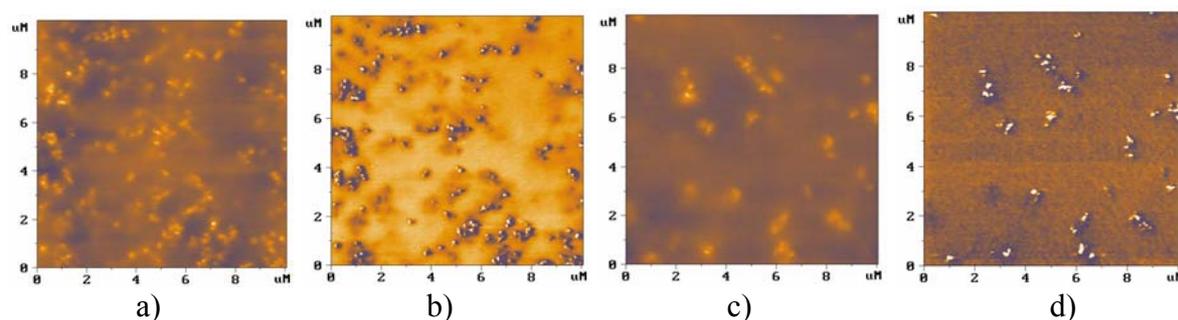


Fig.2. a,b – topography and phase image for the droplet with 5% of CB; c,d – topography and phase image for the droplet with 1% of CB. Time of curing is the same for both images.

Sample 3. Surface topology of polymeric films with embossed gratings of different pitches. The influence of the embossing conditions on the final relief structure has been studied. All obtained results can be processed by using special software. As a result a list of parameters for all scans are saved in computer (Fig.3).

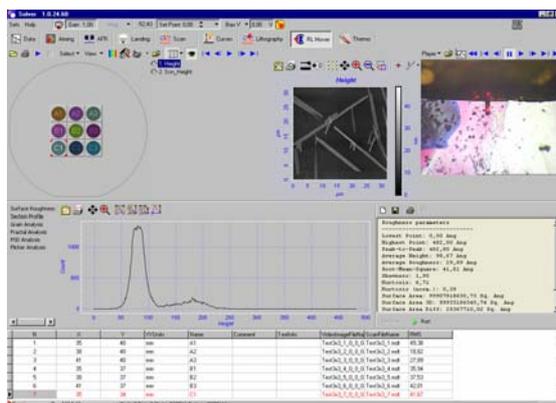


Fig.3. Automatic data analysis.

The next steps in development of automated AFM are: combination of measurements and analysis, connection of the automated AFM and Combinatorial Synthesizer. Question of reliability of such measurements is also still open: measurements of the large number of scans require a possibility of automatic exchange of the tip.

Authors thank C. Sanchez, W. Posthumus and R. Nefatti (TU/e) for the samples used in this work.

1. R. Nefatti, A. Alexeev, S. Saunin, J.C.M. Brokken-Zijp, D. Wouters, S. Schmatloch, U.S. Schubert, J. Loos. *Macromol. Rapid Commun.* 24, 113 (2003).