Nanolayered composites of plasma polymer films

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Well-defined nanolayered composites of plasma polymer films, deposited from tetravinylsilane monomer at different powers by plasma-enhanced chemical vapor deposition on silicon, were intensively studied by in situ spectroscopic ellipsometry, nanoindentation, and atomic force microscopy. A realistic model of the composite structure was used to analyze ellipsometric data and distinguish individual layers in the composite, evaluate their thickness and optical constants. Dispersion dependences for the refractive index were well separated for each type of individual layer, if the thickness was decreased 315 – 25 nm, and corresponded to those of the single layer. A beveled section of the nanolayered composite revealed the individual layers that were extensively investigated by atomic force microscopy (AFM) using height (Fig. 1), magnitude, phase, lateral force, and atomic force acoustic microscopy (AFAM) modes. Nanoindentation measurements were carried out in order to evaluate selected mechanical properties of the nanolayered composite in normal direction and individual layers as well.

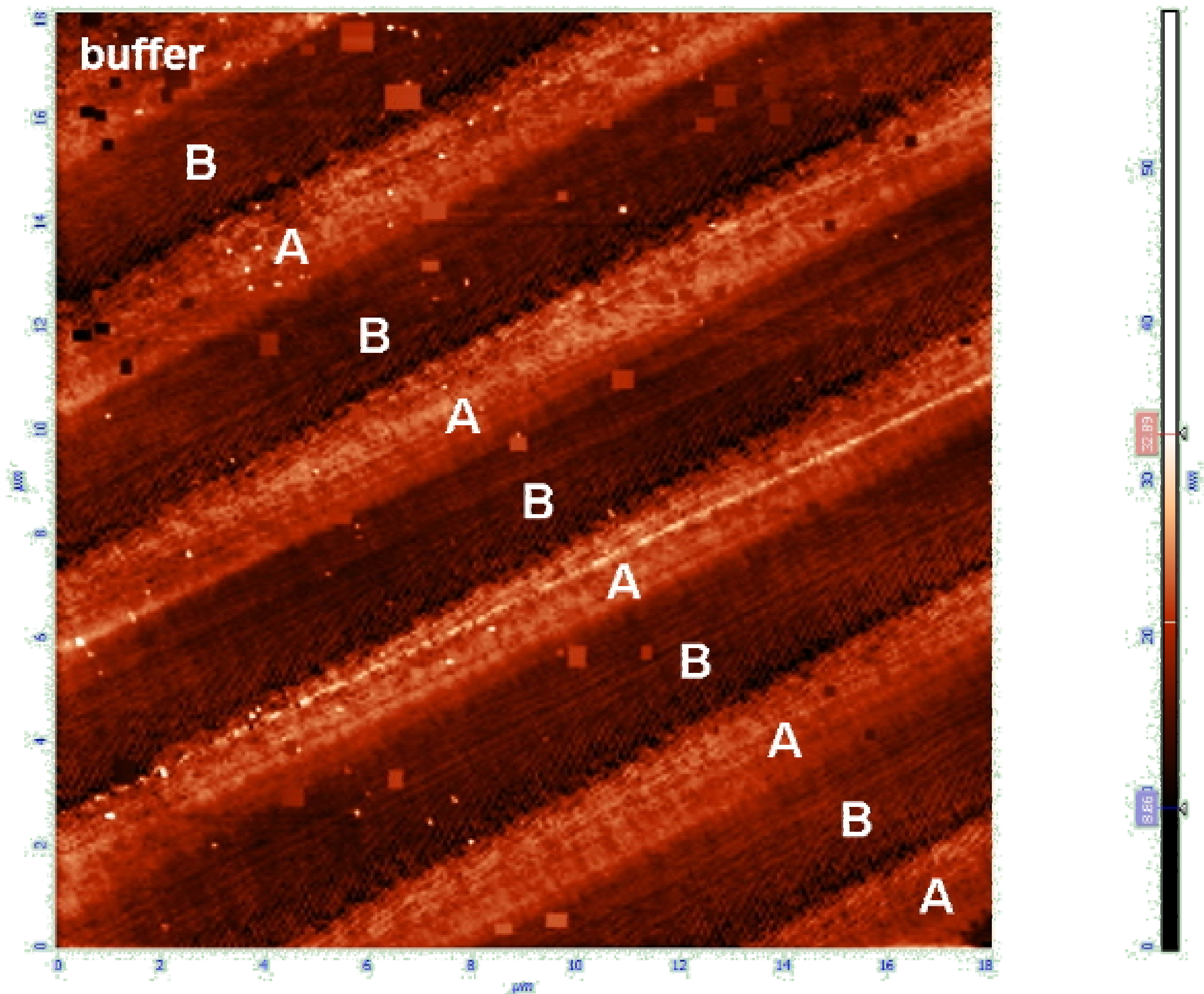

Fig. 1. AFM surface morphology (scan area: 18 × 18 μm^2) of sectioned ten-layered composite with buffer layer. Labels for layers A, B and the buffer layer are provided.