

the formation of a polysiloxane films. The reaction mechanism of the formation of thin film is shown at Fig. 2.

### Results and discussion

It is well known that silanes do not deposit themselves in a uniform fashion, but rather deposit themselves as *sea-island* structures of varying thickness along the length of the fiber.<sup>8</sup> For this reason, the morphology of the silane coating on E-glass fibers was investigated using scanning electron microscopy (SEM). The morphology of pp-VTEO film (Fig. 3a) and polysiloxane film prepared from the solution on glass fibers (Fig. 3b) is approximately of the same character. Atomic force microscopy (AFM) in contact mode was used to examine the surface roughness morphology of the silane coating on tested flat substrates. Pp-VTEO films (Fig. 4a) were more homogeneous with regular porous structure in comparison to thin films deposited from aqueous solution of VTEO (Fig. 4b). Detail chemical composition of pp-VTEO film deposited on glass slides was evaluated by X-ray photoelectron spectroscopy (XPS) and compared with XPS spectrum of polysiloxane film prepared from aqueous solution. Table 1 shows the atomic concentration of oxygen and carbon relative to the concentration of silicon atoms in the pp-VTEO films and thin film formed from silanol solution (sample A). Higher amount of carbon and oxygen in pp-VTEO film indicates different chemical structure. Surface adhesion and wettability was tested on deposited films by plasma polymerization and from solution on flat substrates by contact angle measurement against the following liquids: distilled water, glycerol, ethylenglykol, and diiodmethane using DataPhysics Instruments contact-angle meter OCA 10. The obtained data were analyzed to estimate a dispersive and polar contribution to surface energy according to Owens-Wendt-Rabel-Kaelble method.<sup>9</sup> The results of contact angle measurement are shown at the Table 2.

Table 1. XPS analysis of tested surfaces

| pp-VTEO film     | Power [W]      | C/Si [%] | O/Si [%] |
|------------------|----------------|----------|----------|
| Continual plasma | 50             | 4.5      | 2.5      |
| Continual plasma | 2.5            | 4.2      | 2.1      |
| Pulsed plasma    | 5              | 4.5      | 2.1      |
| A                | 0.5 % solution | 2.4      | 1.6      |

Table 2. Surface energy measuring of thin films

| Type of deposition on glass slides | Surface energy [mN.m <sup>-1</sup> ] | Polar part [mN.m <sup>-1</sup> ] | Dispersive part [mN.m <sup>-1</sup> ] |
|------------------------------------|--------------------------------------|----------------------------------|---------------------------------------|
| Wet-chem. process                  | 72.8                                 | 59.3                             | 13.6                                  |
| Plasma polymerization              | 30.7                                 | 4.7                              | 26.0                                  |
| Untreated E-glass                  | 61.0                                 | 38.7                             | 22.3                                  |

### Conclusions

Thin films prepared from vinyltriethoxysilane monomer by plasma polymerization and wet-chemical process on planar

and fibrous substrates have been compared and characterized in terms of surface morphology (AFM, SEM), chemical structure (XPS) and adhesion to the substrates (scratch test).

Pp-VTEO films are highly crosslinked carbosiloxane materials with porous, but more homogenous and smoother surface morphology in comparison to siloxane films prepared by deposition from solution.

The influence of above mentioned coating techniques of glass fibers on quality of adhesion bonding in glass fiber/polyester system will be study using microbond test, short beam shear test and DMA.

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### L11 A NOVEL WELL-DEFINED LINEAR POLY(METHACRYLIC ACID) MACROMONOMERS FOR BIOMATERIAL APPLICATIONS: THE SYNTHESIS AND CHARACTERIZATION

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### Introduction

Macromonomers (oligomers with  $M_n \sim 10^3 - 10^4$  that contain functional group suitable for further polymerizations<sup>1</sup>) allow for control of a wide variety of properties of the species prior to polymerization into final product. The control of rheological properties, for example, is useful in coating and adhesive applications. Monomers, by definition, are of low molecular weight and because of their low viscosity do not possess favorable pro-

