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Study of electrically conductive water-based polyurethane

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Electrically conductive polymers have shown great potential for several applications in electronic, environmental, and biomedical fields. In particular, polyurethane is used in electromagnetic shields1, in electrodes for capacitive deionization in the desalination process of brackish water4, and in electrodes for electrocardiography2 and electroencephalography monitoring3, and electrostimulation5. Conductive composite materials can be realized as compact (film) or porous (foam) layers, depending on the process. For polyurethane, literature reports different recipes depending on the final material features. This implies the use of a wide range of reagents and additives, and it goes against the tendency of manufacturing companies focusing on the reduction of chemical products and raw materials in their processes. The purpose of this study is the industrial development of electrically conductive water-based polyurethane, suitable both for foam and film casting. In this study, polyether, polyester, and polycarbonate based polyurethane is used and mixed with different cross-linkers and conductive fillers. Five different compounds in similar concentration are compared as cross-linkers. Different loadings of silver based conductive fillers are used. The foam is obtained by mechanical frothing from the mixture of components used for the film. Paper transfer coating process is used to realize both films and foams for testing. Different paper release materials are considered. Surface resistivity is measured by two-point probes method. Results show that the conductivity of the material depends on all the considered variables in different ways. The main contribution is given by the conductive filler loading, with a percolation threshold about 45% wt. The surface resistivity increases about three orders of magnitudes from film to foam. This loss of conductivity can be recovered by increasing the filler loading. The water-based conductive polyurethane prepared in this work, can be successfully realized in porous or compact layers by industrial process manufacturing, with a cost-saving formula using reduced number of components.

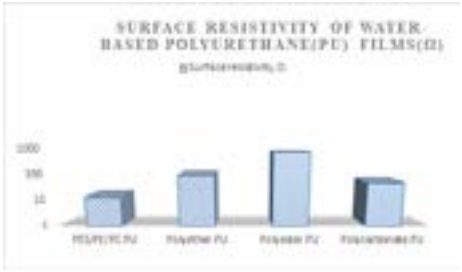

Figure1: *SEM images of the shell/core connection in A) sandwich structured, B) layered composite*

Biography

Valentina Caba has her expertise in waterborne and solventborne polyurethane coating. She has developed this formula of conductive polyurethane after years of experience in research and developing of polymer coating on paper release. The conductive polyurethane formula could be incorporated into the production of the textile coating, which leads to the broadening of synthetic leather application. With her interest in eco-friendly components she is looking for improvement of raw materials quality and the use of chemicals with low or zero volatile organic compounds.

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