MICROINDENTATION HARDNESS OF PARTICULAR POLYMER COMPOSITES

Jiří Minster*, Ladislav Berka**, Julia Hristova†

The applicability of Vickers microhardness measurements for mechanical assessment of heterogeneous polymer composites (filled polymer composites and polymer concretes) is discussed in the paper. Two types of composites based on epoxy and polyester matrices were investigated. Two types of finely dispersed fillers were used: hard (marble powder) and soft (powdery PVC). The volumetric concentration of the individual fillers was 20 %. Experimental indentation tests were performed with an Anton PAAR (MHT 10V) Vickers microhardness tester with a video measuring system. The Meyer power law was used for identifying individual phases of a heterogeneous material. Since the physical parameters of the Meyer power law of all measured phases were close to two, a simple dependence was defined of Vickers microhardness values (MHV) on strength parameters. The reinforcing effect of the hard filler and changes in the microhardness (i.e., in the yield strengths and moduli) in the neighbourhood of filler micrograins were also substantiated. A prediction of viscoelastic moduli of the investigated particulate composites by the application of the (n+1) phase model is discussed in brief.

Key words: *Vickers microhardness, particular polymer composites, inclusion, filler, mechanical characteristics*

1. Introduction

The Vickers hardness test is commonly used to characterize the hardness of materials. Microhardness is understood as the hardness of a small volume of material, determined through measurements on special apparatus under very low loadings [1]. It is defined as the ratio of the used load to the indent area. Microhardness values of homogeneous materials are generally higher than macrohardness values. Modern apparatus for microhardness measurements reduce the influence of various disperse factors resulting from the construction of the apparatus and the technique that is used. The apparatus enables the load, the rate of loading and maintenance of full contact to be programmed. The experiments are simple to perform, need only a small quantity of material (the samples have to be polished and cleaned), are generally non-destructive, and can easily be repeated many times. This makes it possible to design a measurement for any desired confidence level, and to distinguish between the precision of the result and the hypothetical heterogeneity of the sample [2]. The localised nature of the microhardness test allows information to be obtained regarding the

* J. Minster, Institute of Theoretical and Applied Mechanics, Czech Academy of Sciences, Prosecká 76, 190 00 Prague, Czech Republic

** L. Berka, Czech Technical University in Prague, Faculty of Civil Engineering, Thakurova 7, 166 29 Prague, Czech Republic

† J. Hristova, Central Laboratory of Physico-Chemical Mechanics, Bulgarian Academy of Science, Acad. G. Bontchev St. Bl.1, Sofia 1113, Bulgaria