Editorial corner – a personal view

Purposeful surface treatment of nanoparticles for tuning structure and properties of polymer based nanocomposites

*M. Q. Zhang**

Materials Science Institute, Zhongshan University, Guangzhou 510275, P. R. China

Polymeric nanocomposites have been an area of intense industrial and academic research for the past twenty years. As viewed from literature, however, the properties of nanocomposites are sometimes not significantly improved or even worse than those of the matrices. This used to result from direct incorporation of nano-scale building blocks into polymers. Because of the strong tendency of nanoparticles to agglomerate, nano-size fillers are hard to be uniformly dispersed in polymers by conventional techniques. In this context, surface modification of the nano-fillers, that is able to increase hydrophobicity of the inorganic fillers, enhance interfacial adhesion via physical interaction or chemical bonding, and eliminate the loose structure of filler agglomerates, should be a key issue.

Comparatively, the achievements in modern chemistry (incl. grafting techniques, click chemistry, non-covalent bonding, etc.) are much more prominent than those in compounding techniques. Therefore, there are enormous possibilities for modifying nanoparticles. The combination of different surface treatment methods with existing mixing machines would generate nanocomposites with tailor-made structure and performance and enrich the measures of nanocomposites manufacturing.

In general, homogeneous dispersion of the fillers is considered to be the main concern, but in fact, it can not guarantee good properties of the nanocomposites. In addition to the dispersion, filler/matrix interaction and filler/filler interaction exert critical influence on the composites properties. A proper

surface functionalization approach should take account of all these issues and eventually leads to the optimal microstructure with the help of carefully designed processing parameters.

Naturally, a problem has arisen: what is the desired arrangement of the nanoparticles in matrix according to different properties requirements? So far, theoretical consideration of the mechanisms involved in nanocomposites with adequate predictability is relatively less reported. Design and production of polymer nanocomposites have to be mostly conducted on a trial and error basis. Empirical extrapolation of the parameters related to components selection and processing technique is not very successful.

On the basis of analysis hereinbefore, it can be concluded that one has to firstly have a clear image of the proposed nanocomposites and the microstructure, and then start to work out a feasible route of surface treatment of nanoparticles and the way of compounding. The importance of each step mentioned above should be equally considered.

Prof. Dr. Ming Qiu Zhang
Member of International Advisory Board

*Corresponding author, e-mail: ceszmq@mail.sysuedu.cn
© BME-PT