Express Polymer Letters Vol.18, No.8 (2024) 778
Available online at www.expresspolymlett.com
https://doi.org/10.3144/expresspolymlett.2024.57

Editorial corner – a personal view

Two-components one-phase polymer-polymer composites ("molecular composites")

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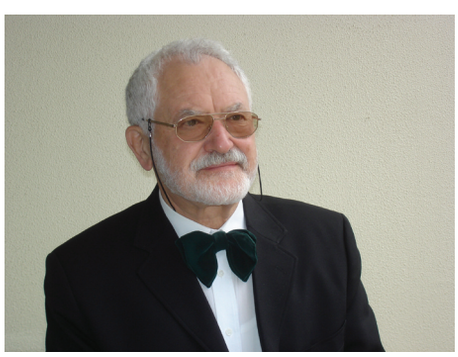
One fundamental issue in composites science and technology is the quality of the interface boundary between the matrix and reinforcement, which impacts the effectiveness of load transfer and hence the degree of reinforcing effect. In the most typical scenario of glass-fiber composites, the fibers are treated with a sizing agent to reduce the significant chemical composition difference between matrix and reinforcement. Polymer-polymer composites were created for the same reason, as well as to address environmental issues. The final solution to the challenge was the development of single polymer composites (https://doi.org/10.1007/BF00554928), which are one-component systems with no interface boundary. The goal of this short communication is to propose two-component polymer blends with no interface boundary that can be used as a starting material for the formation of polymer-polymer composites using the concept of microfibrillar composites (MFC) (ISBN 978-1-56990-510-4, Chapter 11). Such MFCs are free from the interface boundary between the matrix and reinforcement issue. This refers to polymer pairs that are thermodynamically miscible, that is mutually soluble at the molecular level. Polymer pairs are generally not thermodynamically miscible, but there are several exceptions. Selecting one that meets the requirements for preparing an MFC:

(i) a melting temperature difference of at least 40° C between the two components,
(ii) melt blending with extrusion as bristle and cold (around the glass transition temperature, T_g) of the reinforcing component) drawing, followed by
(iii) thermal treatment at temperatures between the crystalline melting temparature (T_m) of both components to create an isotropic matrix (https://doi.org/10.1016/j.compscitech.2013.10.007). The blend ratio must be chosen so that no component crystallizes. For testing the described idea, a promising blend appears to be poly(butylene terephthalate)/polyarylates, for which a single T_g was detected in all compositions in amorphous state (https://doi.org/10.1016/S0032-3861(97)10030-1).

The unique feature of such a polymer-polymer composite is that the reinforcement occurs at molecular level by single molecules dispersed in the usually dominating matrix molecules; the creation of larger one-component phases is avoided, and the blend is a one-phase system. The composites are referred to as "molecular composites".



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