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Editorial corner – a personal view
Trends in composite materials: the challenge of single-polymer composites

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An important contribution to environment preservation and energy saving may come from our ability to recover, recycle and/or reuse the materials. Consumer consciousness, waste management regulations and environmental legislation are all pushing the manufacturers of raw-materials and end-products to carefully consider the environmental impact of their products at all stages of the life cycle, including ultimate disposal.

This scenario obviously involves also composite materials, increasingly used in several industrial sectors. In fact, there is a marked interest to improve the methods for recycling and reusing the existing composites, or to develop new ones intrinsically more suitable to be recycled and reused. In this framework, a great deal of efforts has been expended for the development of the so called 'single-polymer' composite (SPC) materials, in which both the reinforcing and the continuous phases are polymers with the same chemical composition. These materials have been also denoted as one-polymer composites, homocomposites, all-(the same) polymer composites, or homogeneity composites. The main advantage of SPCs is that, unlike traditional heterogeneous composites (such as glass- or carbon reinforced polymer composites), they can be entirely melted down at the end of the product life for recycling.

The first example of this kind of composites was reported by Capiati and Porter in 1975, who introduced the concept of single-polymer composites by successfully preparing polyethylene/polyethylene composites. More recently, the preparation of polypropylene, poly(ethylene-terephthalate), poly(ethylene-naphthalate), and liquid-crystalline copolyesters single-polymer composites has been extensively studied.

In most cases, SPCs have been obtained through the so called 'hot compaction' technique. The use of temperature and pressure to control the melting of the outer surface layer of polymeric fibres implies that the processing window for the hot-compaction process is quite narrow. Other processing techniques include film or fibres stacking, powder impregnation, solution impregnation, etc.

An intriguing challenge for materials scientists and engineers is to explore new materials combinations to extend the processing window and to develop processing techniques sufficiently versatile to be scaled up at an industrial level.

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