Editorial corner – a personal view

Polymer-based sensors: A high potential to be further developed

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Inorganic materials are frequently used to manufacture sensors. However intensive research efforts have been produced in order to develop the large potential of polymers in the field of sensing and monitoring.

The chemical diversity of plastics, their ‘tunability’ and their ability to be industrially processed using economically viable technologies with high productivity can actually be profitable to produce sensing devices or active elements of sensors exploiting a wide range of functional properties (e.g. electrical, dielectric, piezoelectric, pyroelectric or optical properties; weight or dimensions variations, etc). The final products obtained that way may then compete with more traditional components based on metals or ceramics, which are often brittle, require very constraining processing conditions (high temperatures, clean rooms...) and are compatible with a limited number of substrates only. Moreover, they may show functionalities difficult to reach by other ways.

Specialty polymers are used for this kind of applications. They are generally quite different from the commodity and engineering plastics usually used in the plastics industry and may require adapted processing techniques (such as microstructuring for instance).

These organic materials seem to be very promising for a broad range of practical applications: detection of chemical components, solvents, aromas, moisture, contacts, leakage; measurement of force, deformation, temperature, pH, etc.

Well known examples are fluorinated polymers (polyvinylidene fluoride, polytrifluorethylene) used for their piezoelectric and/or pyroelectric properties in force and/or heat sensors, intrinsic (polypyrrole, polyaniline) or extrinsic (addition of conducting particles such as carbon black, carbon nanotubes, metals or metal oxides) conducting polymers used in the electronic noses (detection of volatile organic components). Another example is the detection of moisture by means of polymers such as poly(ethylene glycol), poly(methyl methacrylate), polyimides, polypyridine or various derivatives of cellulose.

Other developments for more specific applications are also going on, such as biosensors/biochemical sensors, using polymers on which enzymes are chemically linked or polymers whose degradation is catalysed by some enzymes, which can result in a capacity variation.

Polymer-based sensors undoubtedly represent both a fertile ground of further scientific developments and an interesting high added-value outlet for the plastics industry.

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