

Adhesion to Fluoropolymers: Rapra Review Report 183 (Rapra Review Reports)

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Fluorinated polymers have a number of very useful properties such as excellent chemical resistance. However, they are usually difficult to bond without a pretreatment. There are exceptions and untreated poly(vinylidene fluoride), for example, may be successfully bonded with an amine-cured epoxide. The most effective methods to pretreat fully fluorinated polymers were developed in the 1950s. Much work, especially on electrochemical and plasma treatments, has since been carried out but to date these have not proved as effective as the early methods. Partially fluorinated polymers may be treated like polyolefins, for example, flame, and plasma treatments are very effective. Aqueous and alcoholic solutions of Group I hydroxides are also very effective. Fluoropolymers can provide a combination of properties including high temperature resistance, excellent resistance to many chemicals and ultraviolet (UV) radiation, fire resistance and low friction. Fluoropolymers are relatively expensive and they are generally used in specialised applications such as linings for chemical plant, spacecraft coatings that are resistant to atomic oxygen, fire-resistant coatings for cables, and of course, non-stick functions. There are more than twenty different fluoropolymers that are commercially available. Good adhesion is required in a number of technologies involving fluoropolymers including adhesive bonding, painting, printing, metallisation (via vacuum or solution) and composite production. However, fully fluorinated polymers such as PTFE and FEP are notoriously difficult to adhere to, while partially fluorinated polymers such as PVDF and PVF may cause problems depending on the circumstances. To achieve a satisfactory level of adhesion, it is often necessary to carry out a pretreatment with both fully and partially fluorinated polymers. In this review the principles of adhesion are considered first (Section 2). Techniques that have greatly increased our understanding of adhesion to fluoropolymers are described in Section 3. Cases where good adhesion is achieved without a pretreatment are examined in Section 4. However, as pretreatments are usually needed to get the required level of adhesion, this review is mainly concerned with the wide variety of methods available to pretreat fluoropolymers (Section 5). A general discussion and conclusions follow. This Rapra Review Report comprises a concise, expert review, supported by an extensive bibliography compiled from the Polymer Library on the topic of adhesion to fluoropolymers. This bibliography provides additional information on this topical field. This review will be of interest both to those who already use fluoropolymers and those who are considering using them.

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