



Materials Engineering Branch

TIP*



No. 100 Room Temperature Curing Polymers for Aerospace Hardware

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There are two major categories of polymers from which many products are fabricated. They are thermoplastics and thermosets. As thermoplastic materials soften when heated, some of these have limited value for many space applications. Therefore, this TIP addresses only the latter type in the construction of spacecraft and related hardware.

The term "cure" as applied to polymers (plastics) is sometimes used synonymously with the term polymerization. Simply stated, polymerization is the building of higher molecular weight structure in compounds. This buildup in organic compounds can proceed at different rates depending upon species involved. The process can vary from almost an imperceptible reaction to a very rapid exothermic reaction.

A few years ago, when polymer chemistry was still growing rapidly, the choice of materials was much more limited than it is today. Now there are silicones, polyurethanes and epoxies that can be cured at room temperature that meet the outgassing requirements of 1.00% TML and 0.10% CVCM according to ASTM E 595-93. Formerly, many such compounds had to be cured at elevated temperatures to meet this requirement.

The disadvantages of curing at elevated temperature are: (1) an additional step(s) in the procedure as well as a cost increase and (2) the temperature of the cure may exceed the rating of some of the components in the fabricated product, or even if it is not exceeded, the components may be compromised.

This recommendation does not suggest that elevated temperature curing should be eliminated; but where a choice exists, the room temperature option should be given serious consideration.