Scope of ASTM D2240

Some project specifications in Oil & Gas and Petrochemical installations call for passive fire protection materials to be tested according to ASTM D2240 ("Shore D hardness").

The subject of ASTM D2240 is "Standard Test Method for Rubber Property—Durometer Hardness". Essentially, the test method comprises a 1.4 mm conical tip steel pin that is pressed into the surface of the material, with a certain spring force. The level of indentation by the pin determines the hardness reading. The method is typically used as a measure of hardness in polymers, elastomers, and rubbers. Different empirically determined combinations of pin dimensions and spring forces exist, indicated by a letter, such as Shore D.

Relevance for Passive Fire Protection

The Shore D hardness reading depends on the viscoelastic properties of the material. As such, it can be used as a measure for the curing of a paint: when the viscoelastic properties no longer change, the paint has fully cured. In that sense, the relative hardness value (absence of change over time) is more relevant than the absolute value. As with any paint, Shore D hardness can be used to check the proper curing of Intumescent Fire Resistive Materials (IFRM's). The Shore D hardness has no relation with the fire resistance performance of the material.

Cementitious spray mortars (Spray Applied Fire Resistive Materials, SFRM's) do not exhibit the rubber-like viscoelastic behaviour that is characterised by the Shore D hardness. As far as the indentation of the material in the test is elastic (reversible), there is a relation between the modulus of elasticity (Young's modulus) and the Shore D hardness. Generally, a lower modulus of elasticity will allow the material to better follow eventual deformations of the substrate. In that sense, if any requirement should be given regarding the Shore D hardness of SFRM's, it should be a maximum value rather than a minimum value. Nevertheless, this is only an indirect indication of the fire resistance performance, as even an SFRM exhibiting hairline cracks as a result of substrate deformation generally has an unreduced fire resistance capacity. Therefore Promat recommends to use alternative methods instead of ASTM D2240 for SFRM's.

Alternative evaluation basis for Promat FENDOLITE® MII

Instead of using ASTM D2240, Promat recommends that the correct performance should be evaluated in three steps:

- Proper bonding to the substrate: no adhesive failure allowed in ASTM E736 tests,
- Demonstrable fire performance of cracked material, by fire tests or validated models,
- Depending on weather and aesthetical requirements, application of a suitable topcoat.

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