



**Cast and Extruded Acrylic Sheet : Fire
Properties**

Technical Service Laboratory Report

Introduction

The Perspex SA range of Cast Acrylic Sheet, sold under the trade names of "Perspex"®, SWG "Perspex"®, and "Karran"®, is a combustible material, but it is not readily ignited, and if it does burn, its burning rate is similar to hardwoods. Unlike burning wood, cast acrylic produces little or no smoke on combustion, and does not continue to smoulder after the fire has been extinguished. Cast acrylic does not melt or drip when burning, and is thus less likely to propagate a fire than extruded acrylic, which does melt and drip.

a. 'Perspex'® Cast Acrylic Sheet Fire Tests

Test Results:

1. BS 476: Part 7 (UK)..... Rating: Class 3
2. Cast acrylic has a burning rate by BS 2782, 1970, Method 508A (UK) of:
3mm sheet28mm/min.
6mm sheet 22mm/min.
3. ASTM D 635 (USA).....Burning rate: 33mm/min.
4. BS 476, Part 3, 1958 (UK); External Fire Roof Tests Rating: "SDDX"
5. DIN 4102 (Germany) Rating: B2
6. NEM 3883 (Holland) Rating: Class 3 – without drips.
7. NFP 92-307 (France) Rating: M4 – without drips

b. Extruded Acrylic Sheet Fire Tests

Extruded acrylic burns at a similar rate, and with similar combustion products, to cast acrylic sheet. However, due to its lower molecular mass, extruded acrylic melts on combustion, may flow, and will form molten burning drops of viscous acrylic liquid. These flaming drops represent a potential for an accelerated spread of fire compared to cast acrylic, which does not melt or drip due to its very high molecular mass, and therefore will not propagate a fire in this way.

The melting point of extruded acrylic is approximately 230 °C

Test Results

1. BS 476: part 7 Rating: Class 4
2. DIN 4102 Rating: Class B2

c. Mechanism of Combustion

The mechanism of acrylic polymer (poly methyl methacrylate) combustion is that the polymer is broken down to its parent monomer, methyl methacrylate, by the application of heat. This process may take place very slowly, starting at above 200° C, and becoming more rapid at higher temperatures. (For example, it is very rapid at 550° C) The evolved monomer, having a boiling point of 100,5° C, is a vapour under such conditions, and, if ignited, burns cleanly producing principally water vapour and carbon dioxide. No other significant toxic fumes are produced in a free air combustion situation.

Methyl Methacrylate monomer vapour may form mixtures with air in confined spaces. Such mixed vapours may be explosive in the event of initiation by a spark or other means.

The auto ignition temperature of the acrylic monomer is 421° C.

d. Fire Retardant Additives

Certain fire retardant additives can be incorporated into acrylic to reduce combustibility. These are typically phosphorous and halogen containing compounds, such as Beta Tri Chloro Ethyl Phosphate. They do confer some limited retardant properties to the polymer under small source, low temperature combustion conditions, but in a major fire situation are most unlikely to retard combustion. Further, when such fire retarded material does burn, it produces significant amounts of black smoke and the combustion products, which contain phosphorous and halogen compounds, are hence likely to be toxic. Fire retardants also act as plasticizers to acrylics, and therefore tend to give a softened polymer, with, for instance, reduced surface hardness. For these reasons, the use of fire retardants in acrylic sheet is of limited interest and doubtful benefit.