Esprit Project Shows Strong Promise for Flowing Self Reinforced Plastics

Flowing self-reinforced plastic pellets

The Esprit project, funded by the EC FP7 programme, started in 2008 and is a three and a half year project which aims to take Self Reinforced Plastic (SRP) technology to a new level by modifying the fibre and matrix and by radically improving the processing methods.

The aim is to develop production-ready technology utilising advanced selective melting processes, allowing the materials to be flow-moulded without affecting the reinforcing fibre properties.

The Esprit project has completed its first year of research and has carried out an extensive programme of locating, manufacturing and characterising the base materials from which the flowing Self Reinforced Plastics will be made. These are variations on Self Reinforced Polyolefins (srPO), Self Reinforced Nylons (srPA) and Self Reinforced Polyesters (srPet) and some early processing trials have been carried out in order to measure critical temperatures and shrinkage characteristics.

Using SRP materials material usage and component weight is expected to be reduced by 30% for equivalent stiffness over conventional materials, resulting in energy saving in both manufacture and in use through, for example, lighter vehicles.

Early trials of selective heating by means of susceptor additives have shown strong promise and a variety of options are available for development. The aim is to have SRP systems for existing moulding technology and for new specialist moulding technology in order to maximise the commercial potential for these new materials.

Partners have made excellent progress in the pultrusion of commingled yarns into a continuous rod which is subsequently chopped into pellets for flow moulding applications. A custom built line has been running successfully which can produce 5kg/hr of pellets derived from PA, PBT, PP and PET combinations. A special cutter has been developed as these thermoplastic reinforcements present very different characteristics to traditional carbon/glass reinforcements.

The Esprit project now has a stable basis to efficiently make pellet samples derived from the many modified matrix and reinforcement raw materials being generated by other partners. A polypropylene based polymer fibre reinforced composite has been created with an extremely high impact strength. The composite, containing relatively long fibres, shows an unusual but highly attractive combination of high modulus, high strain at break, high impact resistance and low notch sensitivity:

▪ Compared to the polypropylene base material the modulus is increased with almost 100%, the strength is increased with more than 50%, while at the same time the strain at break is still high at over 20%.

▪ The most remarkable property is the notched impact strength: it increases from 3 to 55 kJ/m2. This is much higher than even the best impact modified polypropylenes, while the modulus is much higher.
▪ A self reinforced polyester has been developed that shows a 50% increase in the tensile modulus compared to unfilled polyester, without increasing the density of the material.

These material contain fibres up to 10 mm and can be injection moulded into complex shapes – the challenge being to maintain fibre reinforcement integrity through the whole process.

The optimum processing of the new materials is achieved by standard machines adapted in the areas of plastification, injection phase, the heating of the polymer and the temperature control in barrel and mould. The consortium has been selected to encompass skills in materialmodification, machinery building, testing, processing and manufacture resulting in a strong team of participants: AIMPLAS, AVK, EATC, Comfil, Fibroline, Fricke und Mallah Microwave Technology, IVW, NetComposites(coordinator), PEMU, Polisilk, Promolding, Regloplas, Structoform and Ticona.