Overcome breakage problems in nylon components

PRODUCT APPLICATION NOTES

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OVERCOME BREAKAGE PROBLEMS IN NYLON COMPONENTS

Nylon is an excellent engineering plastic, but suffers from a disadvantage that it is brittle under dry and low temperature conditions. In a number of applications, Nylon components are used as part of a machinery or mechanism. Due to brittleness and lack of flexibility, the frequency of breakage in such components during assembly tends to be high.

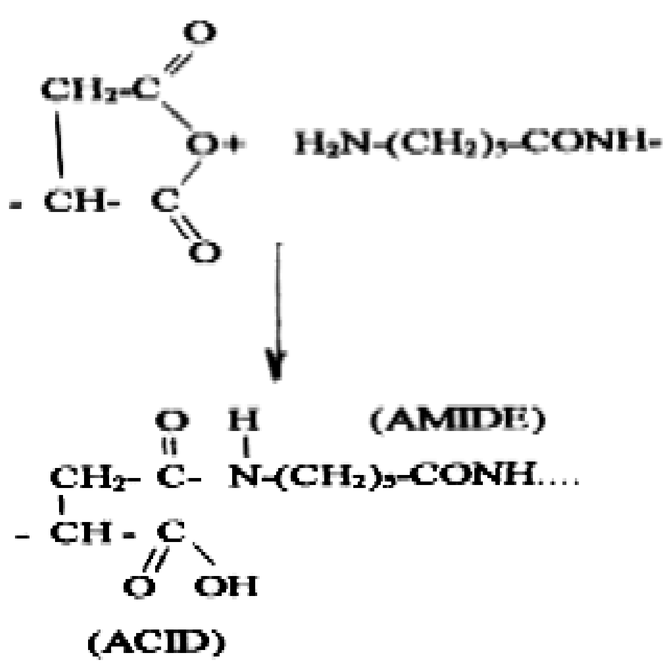
To take care of this problem, the usual approach is to anneal the components in boiling water for couple of hours. Hygroscopic nature of Nylon allows moisture (upto 10%) to be absorbed which plasticizes the Nylon chains and thus increases impact strength. This is a temporary remedy which also adds to the material hold up before it can be dispatched or used.

An alternative solution lies in blending Nylon with a suitable impact modifier. This involves a separate compounding process and is carried out either by the Nylon resin manufactures themselves or by some custom compounders, who then supply these modified Nylons to moulders.

In-Situ Production of Super Tough Nylon

Pluss has developed a novel moulder-friendly technique for in-situ production of super tough Nylon components. This uses OPTIM® E series, a Maleic Anhydride grafted Polyethylene, a product of Pluss Advanced Technologies, which is responsible for the added toughness.

Nylon 6 is dry blended with Maleic Anhydride grafted PE and injection moulded in a screw type machine, at temperatures 5-10°C below the normal processing temperature used for the nylon. The toughening mechanism of nylon is attributed to the following coupling reaction.



Under conditions of average performance of an injection moulding machine, with L/D ratio of 20, the plasticizing screw and passage of the melt through the injection nozzle gives adequate mixing and residence time for a chemical reaction to take place between amine end-groups of Nylon and anhydride groups on OPTIM®. It is these chemically bound polyolefin chains that are responsible for the substantial improvement in impact strength of Nylon by way of alloy formation.

Improvement in notched impact strength as brought about by hopper blending 5 to 10% grafted PE with Nylon 6 and injection moulding. In actual practice, components as small as a few grams (e.g. cable harness) to a kilogram (motor cycle side boxes) have been moulded and shown to have marked improvement in impact strength, often tested in industry by severe tests such as hammering or dropping repeatedly.

The impact strength improvement is more pronounced in annealed samples but it is most significant in unannealed condition (as moulded) since it implies that a nylon component can go through the assembling process directly after moulding, without necessarily going through the annealing step. This means lesser hold up time with the moulder and quicker deliveries to the customer. In addition to the improvement in the impact strength, this in-situ alloying reduces water absorption by the component.

The greatest advantage this in-situ alloying gives to the moulder is that he can choose different proportions of OPTIM® to be used for each component depending upon the improvement desired and not be restricted by the specific grades that a manufacturer or a compounder offers.