The crystallization behaviour of low density polyethylene/nylon 6 blends has been investigated as a function of the composition.

The melting points of the polymers are almost uninfluenced by the presence of the other homopolymers except for blends with a nylon content of 75–90%.

Blends with 10% nylon content do not exhibit the crystallization peak during the cooling step probably because of the low concentration and high viscosity of the low density polyethylene matrix.

The crystallinity degree of the polyethylene is independent of the composition, while some variations are shown by the polyamide.

Finally the rate of nucleation is strongly affected by the composition, in particular for the nylon phase.

An attractive way to modify the properties of polymeric materials and improve their cost/performance ratio is to prepare blends of different homopolymers. However, it is well known that the properties of the blends depend on the properties of the pure polymers, on their preparation and on the physical state of each component at a given temperature.

Many works have been performed on the crystallization behaviour of polymeric blends, but only a few studies deal with blends made with components capable of crystallization [1, 2].

Low density polyethylene (LDPE) and nylon 6 (Ny6) form incompatible blends [3–7]. The interest in these blends is now increasing because the incorporation of the LDPE in the polyamidic matrix helps to dissipate energy and then to improve the impact properties of the Ny6.

The aim of this work is to study the crystallization behaviour of low density polyethylene/nylon 6 blends. Several other properties of these blends have already been investigated [5, 6].
Experimental

The materials used in this investigation were a low density polyethylene and a polycaproamide manufactured by Montedison and SNIA, respectively.

The melt flow index of the LDPE was 0.08 g/10 min (ASTM D 1238/73 method, procedure B) and of the nylon 6 was 10.8 g/10 min (ASTM D 1238/73 method, procedure R).

The blends were prepared by melt mixing the homopolymers in a Brabender Plasticorder mod. PLE 330 at $T = 260^\circ$ and 20 rpm. A mixing time of about 15 min was long enough to get a practically constant value of the torque. Also the homopolymers were subjected to the same treatment.

The wt/wt composition of the blends, $\varphi$, was 0, 10, 25, 50, 75, 90 and 100% nylon 6.

All the samples were kept in a vacuum desiccator and in the presence of silica gel for about 7 days before the tests in order to avoid any effect of the moisture.

The calorimetric tests have been performed with a Perkin-Elmer differential scanning calorimeter, DSC 4, linked to a Data Station Perkin-Elmer mod. 3600.

The following standard procedure was used: the sample (about 15–20 mg) was heated up to 250$^\circ$ at a 20 deg/min heating rate; after 2 min they were kept at this annealing temperature, then they were cooled down to 50$^\circ$ at a cooling rate of 20 deg/min. In a further heating run carried out at 20 deg/min, the crystallinity, $x_c$, and the melting point, $T_m$, of each component were calculated. The crystallization temperature, $T_r$, was evaluated during the cooling step.

Specimens of the blend with $\varphi = 10\%$ were analyzed by a light transmission microscope at a magnification of 150 $\times$ between crossed polarizers.

The microscope was a Leitz Laborlux 12 POL equipped with a heating stage and photographic equipment.

Results and discussion

The thermal curves of all the investigated blends show two distinct peaks. This feature indicates that the blends are completely incompatible.

The crystallization temperature and the melting points, $T_m$, taken as the peak temperatures of the thermal curves are reported in Fig. 1 vs. the composition.

The crystallization temperatures do not exhibit any change with the composition except for the blend with $\varphi = 10\%$. In this case, in fact, no exothermic peak is revealed for the nylon 6, although the subsequent heating step exhibits the usual melting peak of the nylon phase. This unusual feature can be due both to the low crystallization heat and to the very slow crystallization kinetics of the nylon because