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Plasticisation of Recycled PET during Extrusion with Sc CO_2

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This paper describes the effect of liquid CO_2 on pure and recycled PET during extrusion. The aim is to establish the extent of the plasticising effect of CO_2 on recycled PET with a view to lower extrusion temperature to avoid degradation.

The experiments were carried out in a 50mm barrel custom-built single screw extruder fully instrumented for the control of temperature, screw speed and pressure. To ensure good mixing of the melt with the injected CO_2 a cavity transfer mixer and a static mixer sections were inserted between the extruder and the die, immediately after the CO_2injection point. Liquid CO_2 was fed from a cylinder via a variable stroke/volume high-pressure pump suitably calibrated. The injector was a spring driven valve that releases the CO_2 into the melt only after a pressure difference in favour of the CO_2 side occurs at the tip. For the purpose of measuring the rheology of the melts with and without CO_2, a 130mm long 3.0mm diameter capillary die with pressure ports 90mm apart was mounted on the extruder at the end of the static mixer. A bolt die was attached to the capillary die and directed the melt to a cooling bath. This allowed the hall off and collection of long strand samples of the extruded PET for laboratory tests.

The PET grade was a typical copolymer PET used for carbonated soft drinks with an IV of 0.8 and a crystalline melting point of 245^{o}C. Two forms of this polymer were used: a pure granular form dried thoroughly prior to extrusion and the same polymer injection moulded then ground to mimic a recycled version.

The paper will compare melt pressure, flow rate and viscosity data without CO_2 and with CO_2 at various screw speeds and temperatures down to near the crystalline melting point.