Polymer Services Group
Innovation, Application, Evaluation

Controlled Rheology

Remember, that Melt Flow Rate (MFR) is a measure of the melt viscosity of the resin under some standard, yet arbitrary conditions --- one being extremely low shear rate. On the other hand your process, melt spinning and drawing, is performed at probably a different melt temperature and under extremely high shear.

Controlled Rheology polypropylene (CR-PP), also referred to as "viscbreaking" or "cracking", is the controlled molecular weight degradation of polypropylene through the use of peroxides and mechanical shear to produce high MFR (low molecular weight – high flow) resins from low MFR (high molecular weight – low flow) resins. In the process, the higher molecular weight fractions are more susceptible to the chain scission process, therein the PP end product tends to be one with a fairly narrow molecular weight distribution. A PP resin polymerized to the same MFR range will have a broader molecular weight distribution with a high molecular weight tail (absent in the CR-PP). This high molecular weight fraction (or the absence of it), in all likelihood, accounts for the differences you are experiencing.

The high molecular weight tail will resist shear thinning, therefore, the normally-polymerized PP will exhibit a higher viscosity at high shear than the CR product. It will also be capable of achieving much higher draw ratios at constant temperature than its CR counterpart.

The moral of the story: Don't judge a material on its Melt Flow Rate alone. MFR is a nice easy test to determine differences in analogous materials. While both of these materials are polypropylenes, they are different materials --- as you have discovered.

Try measuring the MFR of both materials at higher MFR load conditions (slightly higher shear rate). I suspect you'll observe significant differences in the flow rates of the two materials. Remember, even these high loads will not even come near to approaching the shear rates you are experiencing during melt spinning.

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