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RHEOLOGICAL TOOLS FOR INVESTIGATING STEREOCOMPLEXATION OF PLA

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Abstract. Polylactide is a biodegradable and biobased polymer that has raised much interest as a potential replacement for petroleum-based polymers. PLA is obtained from the ring-opening polymerization of lactide, a cyclic dimer of lactic acid (LA). Since lactic acid is optically active, PLA can be composed of various ratios of L- and D-Lactic acid repeating units. Pure P(L-LA) or pure P(D-LA) can crystallize with crystalline levels up to 50% with a melting point around 170°C. Through fermentation, L-LA is the preferred form but the D-form is also present as a minor component. Dilution of the L-LA with D-LA rapidly decreases the achievable crystalline level and peak melting temperature to the point where materials with a 90:10 L:D radio are completely amorphous. The lactic acid feedstock must therefore be purified in order to obtain a crystallizable material. Interestingly, when P(L-LA) and P(D-LA) are blended together, instead of crystallizing independently, the two polymers can form a stereocomplex. Interestingly, this complex has a melting point around 220°C. Therefore, stereocomplexation could be a route to increase the temperature resistance of the material. The second useful application would be to use small amount of stereocomplex as a nucleating agent for the homo-crystallisation of P(L-LA). This presentation will explore how rheological tools can be used to monitor the strereocomplex formation when small concentrations of P(D-LA) are added to P(L-LA).