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Synthesis of Melamine Formaldehyde Polycondensate as the Thermal Stabilizer of Polyoxymethylene through Ultrasonic Irradiation

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Polyoxymethylene (POM) has a wide range of applications in industry due to its high mechanical strength, excellent abrasion resistance, fatigue resistance, moldability, and the like. The low-molecule weight compounds such as melamine (MA) and dicyandiamide are often used as the main formaldehyde-absorbent of polyoxymethylene (POM) due to their high thermo-stabilizing efficiency. But they are easy to volatilize during high-temperature melting process resulting in the loss of the compounds, reduction of the thermo-stabilizing efficiency and formation of the mould deposit. Excessive use of such compounds even leads to the decrease of the mechanical property of POM. In this paper, MA was polymeric modified by condensation reacting with proper reacting molar ratio of formaldehyde (FA) to form the melamine formaldehyde polycondensate (abbreviation: MF) with high molecule-weight and comparatively high processing thermo-stability to replace MA as the formaldehyde-absorbent of POM. The ultrasonic power was introduced to the synthesis, and the ultra-fine, cross-linked, and thermo-stable MF polycondensates with particle size of 199nm were obtained under the multi-effect of dispersion, crushing and activation of ultrasonic irradiation. The synthesis technique was discussed, and the thermal stabilization effect and nucleation effect of MF on POM was studied by the measurements of isothermal weight loss, isothermal weight loss rate, thermal gravity analysis (TGA) and balance torque, multiple processing and long-term thermal stability at high temperature, polarized light microscopy (PLM), isothermal and non-isothermal differential scanning calorimetry (DSC) and scanning electron microscopy (SEM), which indicated that thermal stability and the crystallization performance of POM was enhanced greatly by applying such MF as the nucleation agent and thermal stabilizer of POM, and the impairment of the mechanical properties of POM by using MF was also solved efficiently.

Keywords: polyoxymethylene (POM), melamine formaldehyde polycondensate (MF), ultrasonic irradiation, thermal-stabilization, nucleation effect