Optimasi kondisi proses terhadap sifat mekanik dan mengetahui sifat flammability komposit polipropilena/clay = Optimizing process condition on mechanical property and knowing flammability property of polypropylene clay

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Abstrak

Nanokomposit polipropilena PP /clay biasanya diproses dengan melt mixing. Melalui metode ini, kondisi pencampuran merupakan variabel penting untuk memperbaiki sifat nanokomposit. Beberapa penelitian melaporkan dampak proses pencampuran pada sifat mekanik PP/clay, namun demikian belum ada penjelasan tuntas mengenai kondisi optimum. Penelitian ini bertujuan untuk mendapatkan kondisi optimal nanokomposit PP/clay yang diproses dengan teknik internal mixer dengan bantuan menggunakan metodologi Design of Experiments DoE response surface. Pengaruh variasi kecepatan putar, waktu pencampuran dan suhu terhadap modulus lengkung dianalisis, didukung dengan hasil X-ray Diffraction XRD dan uji flammability. Untuk meningkatkan ikatan antar muka, PP grafted maleic anhydride PP-g-MA ditambahkan sebagai compatibilizer. Komposisi komposit ditetapkan sebesar 88 wt PP, 9 wt PP-g-MA, dan 3 wt clay. Hasil penelitian menunjukkan bahwa modulus optimum dipenuhi pada 222 C, 83 rpm dan 5 menit, memberikan nilai 2085 MPa atau 18 lebih tinggi dibandingkan sampel kontrol. Difraktogram menunjukkan bahwa puncak [001] clay bergeser ke sudut yang lebih rendah, menunjukkan adanya struktur interkalasi yang didukung oleh hasil modulus. Hasil uji flammability menunjukkan komposit hasil optimasi memiliki nilai cepat rambat 0.0944 s/mm3.

.....Polypropylene PP clay nanocomposites are usually processed by melt mixing. In this method, mixing conditions are important variables to improve nanocomposite properties. Some studies reported the effects of processing on mechanical properties of PP clay, but there is unclear explanation on optimum conditions. This study aims to predict the optimum conditions of PP clay nanocomposite prepared by an internal mixer using Design of Experiments DoE response surface methodology. The effect of rotation speed, mixing time and temperature variation toward flexural modulus were analyzed, supported by X ray Diffraction XRD and flammability test results. To improve interfacial bonding, PP grafting maleic anhydride PP g MA was added as a compatibilizer. Composites formulation was fixed at 88wt of PP, 9 wt of PP g MA, and 3 wt of clay. The results show that the optimum modulus was fulfilled at 222 C, 83 rpm and 5 minutes, giving 2085 MPa or 18 improvement compared to control sample. XRD diffractograms showed that 001 clay peaks shifted to lower angle suggested some intercalated structures that supported to modulus results. The flammability test result show that optimized composite has the highest burn rate 0.0944 s mm3.