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KINETIC ANALYSIS OF PEROXIDE CURED NATURAL RUBBER/LAYERED SILICATE NANOCOMPOSITES USING THERMOGRAVIMETRY

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The thermal stability and kinetics of thermal degradation of natural rubber/layered silicate nanocomposites were studied by thermogravimetric analysis (TGA). The nanoclays selected were cloisite Na$^+$, cloisite 10A, cloisite 15A and cloisite 93A. Gum and commercial clay (English Indian clay) were used as reference materials. Dicumyl peroxide (40% active) was used as the crosslinking agent. The activation energy for the degradation of NR/layered silicate nanocomposites was determined by applying Liu and Fan method. Results showed that the thermal degradation is a first order reaction and organically modified clays exhibited the highest thermal stability.

Key words: Activation energy, Kinetic analysis, Liu and Fan method, Thermogravimetric analysis, Thermal degradation

INTRODUCTION

Natural rubber is a general purpose polymer and its unique combination of properties has made it an elastomer of choice for many industrial applications. Although natural rubber has excellent mechanical properties, these properties may interfere with its low thermal stability. Generally, thermal stability of polymeric materials can be improved by the introduction of inorganic nanoparticles into the polymer matrix.

Thermal stability and thermal degradation kinetics of polymer nanocomposites has been the subject of interest for many years (Blumstein, 1965; Park *et al*., 1985; Petrovic *et al*., 1986; Nam and Seferis, 1991; Nam and Seferis, 1992; Salin and Seferis, 1993; Jimenez *et al*., 1993; Zanetti *et al*., 2001; Qin *et al*., 2003; Li *et al*., 2006; Lezczynska *et al*., 2007(a); Lezczynska *et al*., 2007(b); Erceg *et al*., 2009; Barick and Tripathy, 2010). In general, it has been reported that the polymer/clay nanocomposites are thermally more stable than pure polymers (Kadi *et al*., 2013; Becker *et al*., 2004; Ray and Bousima, 2005; Zanetti, *et al*., 2004). The effect of clay layers has been more explained as superior insulation and mass transport barrier against the volatile compounds generated during the decomposition of polymer under thermal conditions (Varghese and Karger-Kocsis, 2003). Also it has been reported that

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