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International Journal of Precision Engineering and Manufacturing - Green Technology
Volume 7, Issue 1, 1 January 2020, Pages 163-172

Alumina Recovery from Industrial Waste : Study on the Thermal , Tensile and Wear Properties of Polypropylene / Alumina Nanocomposites (Article)

Sufian, A.S.^a, Samat, N.^b,  Sulaiman, M.Y.M.^c, Paulus, W.^c 

^aSchool of Materials Engineering, Universiti Malaysia Perlis, Kompleks Pusat Pengajian Jejawi 2, Taman Muhibbah, Jejawi, Arau, Perlis 02600, Malaysia

^bDepartment of Manufacturing and Materials Engineering, International Islamic University Malaysia, Jalan Gombak, Gombak, Kuala Lumpur 53100, Malaysia

^cMaterial Technology Group, Industrial Technology Group, Malaysian Nuclear Agency, Bangi, Kajang, Selangor 43000, Malaysia

Abstract

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The investigation on the influences of alumina (Al_2O_3) particles in nano-sized retrieved from Aluminium (Al) dross was conducted on the tensile, thermal and wear properties of polypropylene (PP) composites. The thermal decomposition method was used to synthesise the micro $\alpha\text{-Al}_2\text{O}_3$ particles from Al-dross, was followed by the wet-milling method to produce the nano $\alpha\text{-Al}_2\text{O}_3$. The PP composites (nano and micro $\alpha\text{-Al}_2\text{O}_3$ particles) were prepared via melt compounding followed by compression molding. The coupling agent was also added to facilitate the particle dispersion. The tensile tests showed the maximum tensile strength and Young's modulus of both composites to be corresponding to the samples containing 5 wt% of $\alpha\text{-Al}_2\text{O}_3$. The superiority of nano $\alpha\text{-Al}_2\text{O}_3$ on improving the property of PP had also been evident in the abrasive wear performance. A small amount of $\alpha\text{-Al}_2\text{O}_3$ had been adequate in enhancing the thermal stability of PP than that of neat PP. The study on tensile and worn surface with SEM had revealed better adhesion and interaction between the filler and matrix in composites that were treated with coupling agent. The recovery of nano $\alpha\text{-Al}_2\text{O}_3$ particles from Al-dross potentially decreases the quantity of harmful solid waste and can be an effective alternative filler for thermoplastics. © 2019, Korean Society for Precision Engineering.

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

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Funding details

Funding sponsor	Funding number	Acronym
Integrated Envirotech Sdn Bhd		IESB
International Islamic University Malaysia		IIUM

Funding text

The authors wish to extend their gratitude to all parties that had supported the project especially to International Islamic University Malaysia (IIUM), Materials Technology Group Malaysian Nuclear Agency and Mr. Muhammad Shafizaza Rozali from Syfon System Sdn Bhd.

ISSN: 22886206

Source Type: Journal

Original language: English

DOI: 10.1007/s40684-019-00135-z

Document Type: Article

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