ABSTRAK

PENGARUH KOMPOSISI BAHAN, SUHU DAN LAMA WAKTU PEMANASAN TERHADAP KARAKTERISTIK GEOPOLIMER

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Telah dilakukan pembuatan geopolimer menggunakan bahan campuran limbah bata api, serbuk basalt dan alkali aktivator. Penelitian ini bertujuan untuk mengetahui pembuatan geopolimer dari campuran limbah bata api dan serbuk basalt, mengetahui sifat fisis (massa jenis, porositas, absorpsi), karakteristik morfologi, fasa kristal, komposisi unsur dan gugus fungsi. Variasi komposisi limbah bata api dan serbuk basalt yaitu 70:30% ; 80:20% ; dan 90:10% dengan variasi suhu pemanasan sebesar 60, 110, 160 dan 210℃ selama 5 jam. Selanjutnya dilakukan uji fisis dan karakterisasi XRF, XRD, FTIR dan SEM-EDS. Uji fisis pada semua sampel menunjukkan hasil terbaik pada komposisi 70:30% dengan suhu pemanasan 160℃ selama 5 jam diperoleh nilai porositas sebesar 50,51% dan nilai absorpsi sebesar 47,30% dengan nilai massa jenis sebesar 0,65 g/cm^3. Hasil karakterisasi XRF menunjukkan Si, Fe, Al dan Ca merupakan unsur yang dominan. Hasil analisis XRD menunjukkan fasa yang terbentuk pada sampel geopolimer yaitu *quartz* (SiO_2), *cristobalite* (SiO_2), *orthoclase* ($Si_{11.92}Al_{4.08}K_{4.00}O_{32.00}$), *labradorite* ($Ca_{2.68}Na_{1.32}Si_{9.32}Al_{6.68}O_{32.00}$), *siderite* ($Fe_{6.00}C_{6.00}O_{18.00}$) dan *ferrosilite* ($Fe_{6.40}Ca_{1.60}Si_{8.00}O_{24.00}$). Hasil analisis FTIR menunjukkan terbentuknya gugus fungsi Si-O pada bilangan gelombang 1012 cm^{-1} dan Si-O-Al pada bilangan gelombang 970-1090 cm^{-1}. Kemudian hasil SEM-EDS menunjukkan adanya pori-pori dan retakan internal yang tersegmentasi di seluruh permukaan sampel geopolimer, dengan penyebaran unsur Si yang paling dominan.

Kata Kunci : Geopolimer, Limbah Bata Api, Basalt, Silikat, Aluminat

ABSTRACT

THE INFLUENCE OF MATERIAL COMPOSITION, TEMPERATURE AND HEATING TIME ON GEOPOLYMER CHARACTERISTICS

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Geopolymer has been made using a mixture of fire brick waste, basalt powder and alkali activator. This study aims to determine the manufacture of geopolymers from a mixture of fire brick waste and basalt powder, physical properties (density, porosity, absorption), morphological characteristics, crystal phases, elemental composition and functional groups. The composition variations of fire brick waste and basalt powder are 70:30%; 80:20%; and 90:10% with heating temperature variations of 60, 110, 160 and 210℃ for 5 hours. Further physical tests and characterisation of XRF, XRD, FTIR and SEM-EDS were conducted. Physical tests on all samples showed the best results in the composition of 70:30% with a heating temperature of 160 ℃ for 5 hours obtained a porosity value of 50.51% and an absorption value of 47.30% with a density value of 0.65 g/cm3. XRF characterisation results show Si, Fe, Al and Ca are the dominant elements. The results of XRD analysis show that the phases formed in the geopolymer samples are quartz (SiO_2), cristobalite (SiO_2), orthoclase ($Si_{11.92}Al_{4.08}K_{4.00}O_{32.00}$), labradorite ($Ca_{2.68}Na_{1.32}Si_{9.32}Al_{6.68}O_{32.00}$), siderite ($Fe_{6.00}C_{6.00}O_{18.00}$) and ferrosilite ($Fe_{6.40}Ca_{1.60}Si_{8.00}O_{24.00}$). FTIR analysis showed the formation of Si-O functional groups at wave number 1012 cm^{-1} and Si-O-Al at wave number 970-1090 cm^{-1}. Then the SEM-EDS results show the presence of pores and segmented internal cracks on the entire surface of the geopolymer sample, with the distribution of the most dominant Si element.

Keywords : *Geopolymer, Fire Brick Waste, Basalt, Silicate, Aluminate*