Efek Penambahan Sn pada Aktivitas Katalitik NiGa Tersangga Karbon Mesopori untuk Reaksi Karboksilasi Fenilasetilena dengan CO = Effect of Sn Addition on Catalytic Activity of NiGa Supported by Mesoporous Carbon for Carboxylation of Phenylacetylene with CO

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Abstrak

Reaksi karboksilasi fenilasetilena dengan CO dilakukan dengan menggunakan katalis Ni-Ga dan Ni-Ga termodifikasi timah (Sn) yang disangga oleh karbon mesopori (MC). MC disintesis dengan metode soft template dan dianalisis dengan TGA diperoleh kestabilan termal hingga 850 °C. Katalis dikarakterisasi dengan FTIR, XRD, Raman, SEM, TEM, dan BET. Hasil XRD menunjukkan puncak pada 24,47°; 32,73°; 43,83°; 50,96°; 74,32°yang merupakan difraksi NiGa dan partikel Sn(0) pada penyangga MC. Penambahan Sn diketahui tidak mengubah kestabilan katalis NiGa/MC yang dikonfirmasi melalui FTIR dan Raman. Hasil SEM dan TEM juga menunjukkan partikel Ni-Ga-Sn tersebar merata pada permukaan karbon mesopori. BET menunjukkan katalis termasuk dalam ukuran mesopori 2-50 nm. Uji aktivitas katalitik berdasarkan analisa HPLC menunjukkan hasil optimum diperoleh dengan menggunakan katalis NiGaSn,/MC pada suhu 50°C selama 8 jam. Sedangkan berdasarkan LC-MS, diketahui terbentuk produk asam sinamat dan asam fenil propiolat dengan yield masing-masing 2,14% dan 3,04% dengan konversi fenilasetilena mencapai 93,06%.

......The carboxylation reaction of phenylacetylene with CO2 was carried out using Ni-Ga and Ni-Ga-modified tin catalysts supported by mesoporous carbon (MC). MC was synthesized using the soft template method and analyzed using TGA and obtained thermal stability up to 850 0C. To determine the modification effect of Sn addition, catalysts were synthesized with variations of Ni5Ga3/MC, Ni5Ga3Sn0.1/MC, Ni5Ga3Sn0.3/MC, Ni5Ga3Sn0.5/MC, Ni5Ga3Sn0.7/MC, Ni5Ga3Sn0.9/MC. The catalysts were characterized by FTIR, XRD, Raman, SEM, TEM, and BET. XRD results show peaks at 24.47o; 32.73 o; 43.83o; 50.96 o; and 74.32o which is the diffraction of the Ni5Ga3 phase and Sn (0) particles on the MC support. The addition of Sn metal is known not to change the stability of the Ni5Ga3/MC catalyst which was confirmed through FTIR and Raman spectra. SEM and TEM results also show that Ni-Ga-Sn particles are evenly distributed on the mesoporous carbon surface with a spherical shape. BET-SAA shows the pore diameter size of the materials Ni5Ga3/MC, Ni5Ga3Sn0.1/MC, Ni5Ga3Sn0.3/MC, Ni5Ga3Sn0.5/MC, Ni5Ga3Sn0.7/MC, Ni5Ga3Sn0.9/MC respectively, are 6.24 nm; 6.22nm; 7.22nm; 6.24 nm, 7.22 nm, and 10.46 nm which are included in the mesopore size of 2-50 nm. The catalytic activity test was carried out through the carboxylation reaction of phenylacetylene with CO2 using variations of catalyst, time and temperature. HPLC analysis showed that optimum results were obtained using the Ni5Ga3Sn0.5/MC catalyst at a temperature of 500C for 8 hours. Meanwhile, based on LC-MS, it is known that cinnamic acid and phenyl propiolic acid products were formed with yields of 2.14% and 3.04% respectively with 93.06% phenylacetylene conversion.