

Sintesa karbon nanopori dari bahan silikon karbida politipe 6H-SiC

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Abstrak

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Telah berhasil disintesis dan dipelajari material karbon nanopori yang diperoleh dari interaksi antara padatan silikon karbida dan HCl menggunakan metode variasi ultrasonik dan pemanasan. Silikon karbida dengan kemurnian lebih dari 98% dari Aldrich digunakan sebagai sumber karbon, sedangkan larutan HCl berfungsi sebagai sumber gas klor yang akan bereaksi dan mengambil silikon (Si) dari silikon karbida. Dalam penelitian ini diadakan lima variasi yang berbeda yaitu disebut sebagai CDC1, CDC2, CDC3, CDC4 dan CDC5. Metode ultrasonik dan pemanasan terhadap material CDC1, CDC2, CDC3, CDC4, CDC5 didapatkan stabil pada suhu pemanasan 1000 o C dengan perbandingan berat wt% antara silikon karbida dan pori karbon hasil sintesis adalah CDC1 wt% = SiC : C = 75% : 25%, CDC2 wt% = SiC : C = 35% : 65%, CDC3 wt% = SiC : C = 34,5% : 65,5%, CDC4 wt% = SiC : C = 30% : 70% dan CDC5 wt% = SiC : C = 25% : 75%. Pembentukan pori dan pertumbuhan kristal hanya muncul setelah proses pemanasan. Material CDC1, CDC2, CDC3, CDC4, CDC5 hasil sintesis masing-masing memiliki struktur heksagonal dengan grup ruang P6 3 mc dan parameter kisi berturut-turut yaitu a = b = 2,456 Å dan c = 12,350 Å. Pembuktian berdasarkan analisis GSAS refine Fourier memperlihatkan bahwa material CDC1, CDC2, CDC3, CDC4, CDC5 memiliki struktur rentang panjang arah sumbu c untuk CDC1 = 15Å, CDC2 = 15Å, CDC3 = 20Å, CDC4 = 30Å, CDC5 = 35Å terhadap pemanjangan parameter kisi c masing -masing CDC1 = 12,35Å, CDC2 = 15,1Å, CDC3 = 18Å, CDC4 = 20,4Å dan CDC5 = 24,1Å dan mengalami penurunan nilai densitas CDC1= 3 gr/cm 3 , CDC2 = 2,45 gr/cm 3 , CDC3 = 1,5 gr/cm 3 , CDC4 = 1,4 gr/cm 3 dan CDC5 = 1,2 gr/cm 3 . Struktur karbon m akropori - nanopori rentang panjang heksagonal tipe pori silinder memiliki ukuran pori 200 nm - 35 nm, luas permukaan 55 m 2 /gram-1250 m 2 /gram dan sangat khas muncul pada bilangan gelombang 1095, 57 cm -1 dan karenanya material tersebut diharapkan dapat digunakan sebagai media penyimpan gas.

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ABSTRACT

Nanopores carbide derived carbon synthesized from silicon carbide and HCl by using ultrasonic and sintering at high temperature has been investigated. Silicon carbide with a purity better than 98% from Aldrich was used as a carbon source while HCl was used as a leaching agent.. In this investigation, five different processes were carried out, i.e. CDC1, CDC2, CDC3, CDC4 and CDC5. Ultrasonic process and sintering on these five CDC1, CDC2, CDC3, CDC4 and CDC5 materials were found to be stable at 1000 o C with the weight ratio between silicon carbide and the derived carbon CDC1 wt% = SiC : C = 75% : 25%, CDC2 wt% = SiC : C = 35% : 65%, CDC3 wt% = SiC : C = 34,5% : 65,5%, CDC4 wt% = SiC : C = 30% : 70% dan CDC5 wt% = SiC : C = 25% : 75%. Pores formation and crystal growth occur after sintering process. Each derived carbon material has the hexagonal structure and a space group of P6 3 mc and lattice parameters a = b = 2.456 Å and c = 12.350 Å. Fourier analysis by using a package program of GSAS showed that CDC1, CDC2, CDC3, CDC4 and CDC5 have an expansion on the c direction in which CDC1 =

15 Å, CDC2 = 15 Å, CDC3 = 20 Å, CDC4 = 30 Å, and CDC5 = 35 Å from the original values of CDC1 = 12.35 Å, CDC2 = 15.1 Å, CDC3 = 18 Å, CDC4 = 20.4 Å and CDC5 = 24.1 Å. Furthermore, the electronic density was found to be CDC1 = 3 gr/cm³, CDC2 = 2.45 gr/cm³, CDC3 = 1.5 gr/cm³, CDC4 = 1.4 gr/cm³ and CDC5 = 1.2 gr/cm³. The long hexagonal ribbon of the derived carbon has the size of 200 nm × 35 nm, surface area of 55 m²/g × 1250 m²/g and occur at a wave number of 1095.57 cm⁻¹. This material has the potential application as a gas storage.