Pengaruh perlakuan panas terhadap mikrostruktur dan mikrokimia kawat Cu-Nb-Sn luvata waterbury yang dibuat melalui metode internal tin = Effect of heat treatment against microstructure and microchemical wire Cu-Nb-Sn internal tin luvata waterbury

Bintoro Siswayanti, author

Abstrak

[Berbagai variasi pemanasan telah dilakukan terhadap kawat Cu-Nb-Sn Internal Tin Luvata Waterbury untuk menghasilkan kawat superkonduktor dengan kandungan intermetalik A15 Nb3Sn yang memiliki homogenitas mikrokimia dan mikrostruktur. Reaksi pembentukan intermetalik A15 Nb3Sn melalui solid state diffusion couple. Pemanasan dilakukan dalam kondisi terproteksi dari oksigen. Tabung berisi kawat tersebut dipanaskan pada temperatur 450oC, 600oC, 750oC, dan 900oC dengan variasi waktu. Tabung didinginkan dalam tungku baru kemudian dikeluarkan. Identifikasi evolusi fasa tidak bisa menggunakan XRD karena matriks Cu dominan, sehingga penentuan fasa dilakukan dengan memanfaatkan data sekunder sebagai pembanding. Struktur mikro dan komposisi
fasa cuplikan diamati dengan scanning electron microscope (SEM) dan energy dispersive x-ray spectroscopy (EDS). Hasil pengamatan menunjukkan bahwa Sn merupakan elemen utama yang berdifusi pada proses difusi yang terjadi. Pada pemanasan 450oC/72 jam terbentuk intermetalik Nb3Sn, larutan padat -Nb dan juga Nb3Sn yang kurang superkonduktif. Sedangkan variasi perlakuan panas yang lain menghasilkan intermetalik Nb3Sn dengan komposisi % atom Sn yang homogen di sepanjang filament yang diamati. Seluruh variasi perlakuan panas didapati menyebabkan interkoneksi filament yang tidak diharapkan. Pemanasan 750oC dan 900oC didapati menyebabkan pelarutan Nb dari filament. Pemanasan 900oC/72 jam didapati menyebabkan kebocoran kawat sehingga terjadi peracunan selongsong Cu. Pada sisi lapisan intermetalik A15 Nb3Sn yang kaya Sn tumbuh kristal equiaxed sedang pada sisi yang kurang Sn tumbuh kristal columnar. Perlakuan panas optimal pada penelitian ini 600oC/72 jam dan diperlukan jarak antar filament yang lebih lebar untuk menghindari interkoneksi filament. Efek Hartley Kirkendal berupa pergeseran batas muka tampak dengan pergeseran yang kecil.
.....Variations heat treatment have been applied to the wire Cu-Nb-Sn Internal Tin Luvata Waterbury to produce superconducting wire with A15 Nb3Sn intermetallic that has microchemical and microstructural homogeneity. A15 Nb3Sn
intermetallic formation reactions via solid state diffusion couple. Heating is carried out in a protected conditions from oxygen. Quartz tube containing the wire is heated at a temperature of 450oC, 600oC, 750oC and 900oC with time variations. Tube cooled in the furnace and then removed. XRD could not identified phase evolution because the dominant Cu matrix, so that the phase determination is done by using secondary data as a comparison. Microstructure and phase composition of the samples was observed by scanning electron
microscope (SEM) and energy dispersive x-ray spectroscopy (EDS). The results showed that Sn play as main diffusant. The heating 450oC/72 hours generate intermetallic Nb3Sn, -Nb solid solution and also less Nb3Sn superconductive. While the other heat treatment variations produced intermetallic Nb3Sn with % Sn atom in homogeneous along the filament was observed. All the various heat treatment interconnecting

filaments found to cause unexpected. Heating 750oC and 900oC were found causing dissolution of the Nb filaments. 900oC/72 hour heating wire found to cause leakage resulting in the poisoning of the Cu shell. On the side of the A15 Nb3Sn intermetallic layer rich Sn grows equiaxed crystals, whether on the side of less Sn columnar crystals grow. Optimal heat treatment in this study 600oC/72 hours required distance between the filament and wider to avoid interconnecting filaments. Effects Hartley Kirkendal be a shifting boundary face seemed to shift a little., Variations heat treatment have been applied to the wire Cu-Nb-Sn Internal Tin Luvata Waterbury to produce superconducting wire with A15 Nb3Sn intermetallic that has microchemical and microstructural homogeneity. A15 Nb3Sn intermetallic formation reactions via solid state diffusion couple. Heating is carried out in a protected conditions from oxygen. Quartz tube containing the wire is heated at a temperature of 450oC, 600oC, 750oC and 900oC with time variations. Tube cooled in the furnace and then removed. XRD could not identified phase evolution because the dominant Cu matrix, so that the phase determination is done by using secondary data as a comparison. Microstructure and phase composition of the samples was observed by scanning electron microscope (SEM) and energy dispersive x-ray spectroscopy (EDS). The results showed that Sn play as main diffusant. The heating 450oC/72 hours generate intermetallic Nb3Sn, α-Nb solid solution and also less Nb3Sn superconductive. While the other heat treatment variations produced intermetallic Nb3Sn with % Sn atom in homogeneous along the filament was observed. All the various heat treatment interconnecting filaments found to cause unexpected. Heating 750oC and 900oC were found causing dissolution of the Nb filaments. 900oC/72 hour heating wire found to cause leakage resulting in the poisoning of the Cu shell. On the side of the A15 Nb3Sn intermetallic layer rich Sn grows equiaxed crystals, whether on the side of less Sn columnar crystals grow. Optimal heat treatment in this study 600oC/72 hours required distance between the filament and wider to avoid interconnecting filaments. Effects Hartley Kirkendal be a shifting boundary face seemed to shift a little.]