Simulasi pengaruh parameter distribusi orientasi serat MWNT terhadap modulus elastis longitudinal komposit hybrid glass/epoxy-MWNT = Simulation of effect of orientation distribution parameters of MWNT fiber on longitudinal elastic moduli of hybrid composites glass/epoxy-MWNT

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Abstrak

Telah dilakukan penelitian tentang pengaruh parameter distribusi orientasi serat MWNT terhadap modulus elastis komposit hybrid Glass/Epoxy-MWNT. Komposit hybrid ini dipandang sebagai system komposit polimer/serat kontinyu/serat pendek. Beberapa peneliti menyatakan bahwa orientasi serat pendek tidak bisa diabaikan karena berperan penting terhadap sifat mekanik suatu komposit. Disini modulus elastis komposit hybrid dihitung dengan menggunakan model Rule of Hybrid Mixtures (RoHM) dan Rule of Mixtures (ROM). Dalam RoHM, komposit hybrid ini dimodelkan tersusun dari dua jenis komposit yaitu komposit berpenguat serat kontinyu dan komposit berpenguat serat pendek. Modulus elastis komposit berpenguat serat pendek dihitung dengan menggunakan metode Laminate Analogy Approach (LAA) dengan menerapkan variasi kombinasi parameter distribusi orientasi, sedangkan modulus elastis komposit berpenguat serat kontinyu dihitung dengan ROM. Selanjutnya modulus elastis komposit hybrid dihitung dengan RoHM. Sedangkan untuk menghitung modulus elastis komposit hybrid dengan model ROM, maka komposit berpenguat serat MWNT diasumsikan sebagai matriknya dan gelas sebagai seratnya. Model RoHM akan memberikan kemungkinan nilai modulus elastis longitudinal upper dan lower komposit hybrid Glass/Epoxy-MWNT. Modulus elastis longitudinal upper terjadi jika sudut ratarata orientasi serat MWNT searah dengan arah serat Glass. sedangkan modulus elastis longitudinal lower terjadi jika sudut rata-rata orientasi serat MWNT tegak lurus atau normal terhadap arah serat Glass. Model RoHM dan Model ROM memberikan nilai modulus elastis komposit hybrid nilainnya yang meningkat seiring dengan naiknya fraksi volum MWNT Pada model RoHM, parameter distribusi orientasi serat MWNT akan menentukan bentuk kurva distribusi orientasi yang akan mempengaruhi nilai modulus elastis longitudinal dari komposit hibridnya. Modulus elastis akan mencapai maksimum apabila orientasi serat MWNT searah dan sudut rata-ratanya searah dengan arah serat Glass. Sebaliknya nilai modulus elstis akan mencapai minimum apabila distribusi orientasi serat MWNT sama untuk semua arah (random sempurna). Penelitian ini menunjukan bahwa distribusi orientasi serat MWNT akan berpengaruh terhadap sifat modulus elastic komposit hybrid.

.....It had been conducted a research about the effect of fiber orientation distribution parameters on elastic moduli of hybrid composites Glass/Epoxy-MWNT. Hybrid composites was treated as composite system of polymer/continuous fiber/short fiber. Some researchers stated that orientation distribution in short fibre reinforced composites had important role in mechanical properties of composites. Elastic moduli of hybrid composites was calculated by using Rule of Hybrid Mixtures (RoHM) and Rule of Mixtures (RoM). In RoHM, hybrid composites consisted of two types of composites, namely: continuous fibre reinforced composites and short fibre reinforced composites. Elastic moduli of short fibre reinforced composites was calculated by using laminate analogy approach (LAA) by applying varied orientation distribution parameters, while elastic moduli of continuous fibre reinforced composites was calculated by using ROM.

Then, elastic moduli of hybrid composites was calculated by using RoHM. Whereas, to calculate elastic moduli of hybrid composites by using ROM, short fibre reinforced composites was assumed as a matrix and glass as fibre. RoHM model will give prediction of upper and lower longitudinal elastic moduli of hybrid composites Glass/Epoxy-MWNT. Upper longitudinal elastic moduli will occur if MWNT's mean fiber orientation distribution angle is aligned with glass fiber direction. Whereas lower longitudinal elastic moduli will occur if MWNT mean fiber orientation angle is normal to glass fiber direction. RoHM model will give elastic moduli of hybrid composites increasing with the increasing MWNT's volume fraction. In RoHM model, orientation distribution parameters of MWNT fiber will determine distribution curve shape that will effect on longitudinal elastic moduli values of hybrid composites. Elastic moduli will reach their maximum values if MWNT orientation is aligned each other and its mean angle is aligned with glass fiber direction. Otherwise elastic moduli values will reach their minimum values if MWNT orientation distribution is same for all directions (perfectly random). This research showed that orientation distribution of MWNT fibre will effect to elastic moduli of hybrid composites.