Material selection based on Sr2 AlxOy at manufacturing design using Ising model for control rod blade of nuclear reactor 50 megawatts

Moh. Hardiyanto, author

Abstrak

The functional of control rod blade nuclear reactor is stabilized device and controlling for nuclear chain reaction also the flux of thermal neutron in reactor chamber. Selecting materials based on Sr2 AI,;OV for multipurpose research reactor 50 megawatts determined by Ising Model software and programming written in Modula's language. This software consists are 4 main programmes and 38,700 sub-programmes. By simulation of Ising Model found Sr2 A1202, material.
Based on Sr2 AI202_7, had been tested by Magnetic Stirrer equipment and combined with Ising Model expressed the material is Sr2 A12O1.8 . This material shown the strength of thermal neutron flux absorbed about 2.1 x 105 - 1.8 x 106 currie/mm. The values of Electrical Conductivity is 26.62 - 29.98 in 800° - 890° C temperature, however at 2.1 x 10' currielmmn thermal neutron flux condition is 29.44 -- 37.98 values in IAEA standard. At 450 testa magnetic field and 2.1 x 105 currie/mm thermal neutron absorber, the crystallization structure reduction is 6.88% until 10.95% for 25 years period in 45.7 megawatts.
At present material is Zr-4 was substituted by this material, however the cost more cheaper than Zr-4. According datas, then the manufacturing design for control rod blade is investment casting and adhesive bounding with Sr2O2 substance for lining substance processes, compare with present material is casting and welding processes. The value of cubical raiser with sides 1.25 cm has the AIIV ratio as 4.8 cm' l (in standard is 4.1 cnf-') with the volume shrinkage of solidification is 3% for casting process. At joining has the radial tensile stress at the front hub fillet measuring 222 N/mm2 (in standard is 180 NImm2) and the value of tensile test is 405 MPa, meanwhile the standard around 390 MPa.