matter does matter

הפקולטה למדעי ההנדסה
המחלקה להנדסת חומרים

אוניברסיטת בן-גוריון בנגב
Ben-Gurion University of the Negev

סמינר מחלקתי – הנדסת חומרים

הנכם מוזמנים בזאת לסמינר מחלקתי
אשר יתקיים ביום רביעי , 30 בנובמבר 2022 , ו' בכסלו תשפ"ב,
בשעה 14:00 בחדר ישיבות 120 בניין 59

$AlCr_xFeCoNi$ system (x=0,0.2,0.5,1.0,1.8): microstructure, hardness and irradiation resistance

Student: Rotem Shockner
Supervisors: Prof. Louisa Meshi, Dr. Malki Pinkas

Medium and High Entropy Alloys (MEAs and HEAs, respectively) attracted a lot of attention in the last several decades due to their superior physical properties, such as combination of high strength, hardness, thermal stability, and great corrosion, oxidation, and irradiation resistance. Therefore, these alloys are considered as promising candidates to serve as structural materials in the nuclear industry. Most researchers have focused on Face Centered Cubic (FCC)-based HEAs in this regard. AlCrFeCoNi is an example of Body Centered Cubic (BCC)-based HEA which also exhibits listed above properties. However, limited information on irradiation properties of this system exists. Since, as a function of Cr content, the phase content changes in this system from single phase B2 (when there is no Cr) to two phase B2+BCC, first, the effect of radiation on the multicomponent B2 phase was studied. Then, the microstructure, mechanical and irradiation properties of the $AlCr_xFeCoNi$ (where x=0.2,0.5,1 and 1.8) alloys were investigated in a systematic way, by studying Transmission Electron Microscopy (TEM) samples prior and after irradiating by Ar ions.

It was found that at the lowest dose, [100]-type dislocations (dominating in the non-irradiated B2 AlCoFeNi alloy) co-existed with newly formed $[\bar{1}11]$-type dislocations and the density had a moderate increase. As the function of the irradiation dose, dislocations accumulation occurred forming dislocation walls, and at the highest dose recrystallization occurred. Addition of Cr promoted formation of the BCC phase and coarsened the grains. $AlCr_{0.5}FeCoNi$ and $AlCr_{1.8}FeCoNi$ alloys exhibited high irradiation resistance which can be related to their complex microstructure. At x=1.8, the volume of the BCC phase exceeded the B2 phase volume. Furthermore, in the dendrite region reverse of the microstructure occurred: when $0<x<1.8$ - BCC spherical particles were embedded uniformly in the B2 matrix, while at x=1.8 cuboidal B2 particles were found to be homogenously spread in the BCC matrix. Complex behavior of the microhardess value was noted as the function of Cr addition. These results were explained by solid solution strengthening mechanism.

פרופ' מארק שוורצמן
טל. 08-6461470 | marksc@bgu.ac.il
ת.ד. 653 באר-שבע 84105 | cmsprod.bgu.ac.il/engn/mater