EFFECT OF HYDROGEN ON THE NANOMECHANICAL BEHAVIOR OF DUAL-PHASE NANOCRYSTALLINE HIGH-ENTROPY ALLOY

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Recently, for improving the strength of "Cantor" family high entropy alloys (HEAs) Al-added CoCrFeNi HEAs with both face-centered cubic (FCC) and body-centered cubic (BCC) phases are being actively investigated. In this study, high-pressure torsion (HPT) process was conducted for incorporating both the advantages of the dual-phase HEA and a nanocrystalline (NC) structure to maximize the mechanical performance. Then, we explored the contributions of each constituent phase in the NC dual-phase HEA to the overall strength changes due to hydrogenation in consideration of the plastic zone size and indentation size effect (Figure 1). It was revealed that the FCC phase exhibits more hydrogen-induced hardening than the BCC phase and the difference is much smaller in the NC samples where grain boundaries predominate the deformation process (Figure 2). * This work was supported by the National Research Foundation of Korea (NRF) grants funded by the Korea government (MSIT) (No. 2020R1A2B5B01001446 and No. 2020R1A5A6017701).

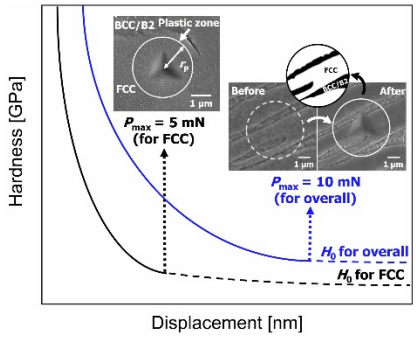

Figure 1. Schematic diagram of ISE calculation process.

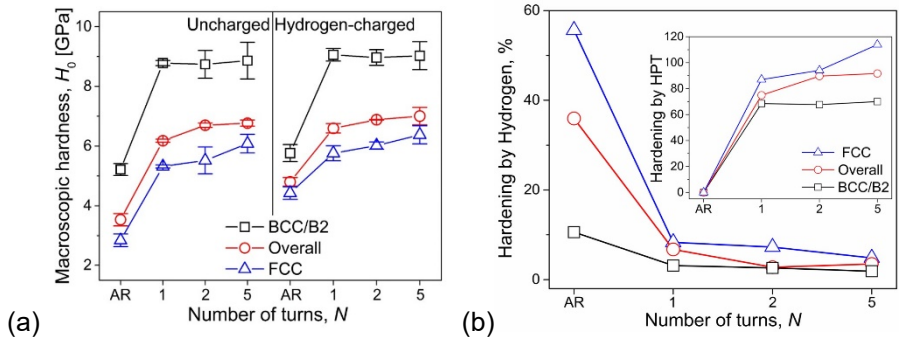

Figure 2. (a) Changes in estimated macroscopic hardness of uncharged and hydrogen-charged samples and (b) hardening ratio by hydrogen charging and nano-graining via HPT (inset).