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Thickness dependence of mechanical properties of free-standing graphene oxide papers TAO GONG, Advanced Institute of Nano Technology (SAINT), Sungkyunkwan University, DO VAN LAM, Nano Mechatronics, Korea University of Science and Technology, SEJEONG WON, Korea Advanced Institute of Science & Technology, RENLONG LIU, School of Mechanical Engineering, SKKU, HWANGBO YUN, Korea Institute of Machinery & Materials, SANGHYUK KWON, JINSEON KIM, School of Mechanical Engineering, SKKU, KE SUN, SAINT, SKKU, SEUNGMO LEE, Nano-Mechanical Systems Research Division, KIMM, CHANGGU LEE, Advanced Institute of Nano Technology, and School of Mechanical Engineering, Sungkyunkwan University, GRAPHENE ENGINEERING LAB TEAM, NANOMECHANICS LAB COLLABORATION — We have characterized thickness dependence of mechanical properties, such as Young's modulus, fracture strength, fracture strain and toughness, of graphene oxide papers using tensile and bulge test methods. The GO papers were made from Hummer's method and the fabricated GO paper's thickness varied from 0.1 $\sim$ 100 μm. The measured Young's modulus and fracture strength decreased with increasing thickness ranging from 44.6 $\sim$ 8.5GPa and 170.2 $\sim$ 40MPa respectively. Through TEM, SEM and AFM characterization, the inner structure and surface morphology such as crack formation and roughness change are the keys to the variation of mechanical properties in the GO papers by the thickness. The thicker GO papers are weaker because it has more manufacturing voids in it that cause it to fail easily and less stiff. Surface wrinkle and residual stress are the mechanism of terraced fracture strain.

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