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UNUSUALLY LARGE YOUNG'S MUDULI OF AMINO ACID MOLECULAR CRYSTALS* IDO AZURI, ELENA MEIRZADEH, DAVID EHRE, Department of Materials and Interfaces, Weizmann Institute of Science, Rehovoth, Israel, SIDNEY R. COHEN, Chemical Research Support, Weizmann Institute of Science, Rehovoth, Israel, ANDREW M. RAPPE, The Makineni Theoretical Laboratories, Department of Chemistry, University of Pennsylvania, Philadelphia, PA, USA, MEIR LAHAV, IGOR LUBOMIRSKY, LEEOR KRONIK, Department of Materials and Interfaces, Weizmann Institute of Science, Rehovoth, Israel — Young's moduli of selected amino acid molecular crystals were studied both experimentally and computationally using nanoindentation and dispersion-corrected density functional theory. The Young modulus is found to be strongly facet-dependent, with some facets exhibiting exceptionally high values (as large as 44 GPa). The magnitude of Young's modulus is strongly correlated with the relative orientation between the underlying hydrogen-bonding network and the measured facet. Furthermore, we show computationally that the Young modulus can be as large as 70-90 GPa if facets perpendicular to the primary direction of the hydrogen-bonding network can be stabilized. This value is remarkably high for a molecular solid and suggests the design of hydrogen-bond networks as a route for rational design of ultra-stiff molecular solids. *Angew. Chem. Int. Ed.. doi: 10.1002/anie.201505813

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