Omar M. Yaghi

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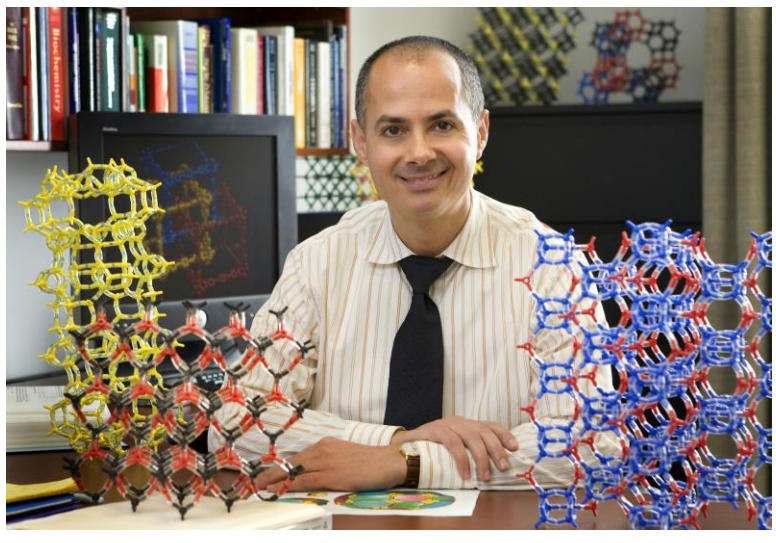

Friday, February 12, 2021 | **ZOOM** | 1:00-2:30 PM (ET)

Title | The Discovery and Reticular Chemistry of Covalent Organic Frameworks

Abstract | The synthesis of covalently-linked organic extended structures has been a long-standing objective. The fundamental problem is that attempts to link organic molecular building blocks into extended structures often led to intractable amorphous solids and ill-defined materials, thus impeding development of this field. This changed when the reaction and crystallization conditions for making covalent organic frameworks (COFs) were worked out and reported in 2005 for 2D COFs and 2007 for 3D COFs. This advance extended the field of organic chemistry beyond discrete molecules (0D) and polymers (1D) to infinite layered (2D) and network (3D) extended structures. COFs are entirely constructed from strong covalent bonds (C-B, C-C, C-N, C-O, and B-O), and therefore they have high thermal stability (400 to 500 °C) and extremely low density (0.17 g/cm3). The discovery of reactions and crystallization conditions for making COFs using reversible as well as what is traditionally considered irreversible linkages (e.g. dioxin, olefin) will be outlined. The recent developments in (1) making large single crystals of COFs, (2) the first molecular weavings, (3) greatly expanding structural complexity of COFs through building high valency nodes, and (4) water harvesting from desert air COFs will be presented.

Bio | Omar M. Yaghi is the James and Neeltje Tretter Chair Professor of Chemistry at University of California, Berkeley. His work encompasses the synthesis, structure and properties of inorganic and organic compounds and the design and construction of new crystalline materials. He is widely known for pioneering several extensive classes of new materials: Metal-Organic Frameworks (MOFs), Covalent Organic Frameworks (COFs), and Zeolitic Imidazolate Frameworks (ZIFs). These materials have the highest surface areas known to date, making them useful for hydrogen and methane storage, carbon capture and conversion, water harvesting from desert air, and catalysis, to mention a few. The building block approach he developed has led to an exponential growth in the creation of new materials having a diversity and multiplicity previously unknown in chemistry. He termed this field 'Reticular Chemistry' and defines it as 'stitching molecular building blocks into extended structures by strong bonds'.

Yaghi is an elected member of the National Academy of Sciences of the United States, and has been honored with many awards for his scientific accomplishments, including the Materials Research Society Medal (2007), the American Chemical Society Award in the Chemistry of Materials (2009), the King Faisal International Prize in Science (2015), the Royal Society of Chemistry Spiers Memorial Award (2017), the Albert Einstein World Award of Science (2017), the BBVA Foundation Frontiers of Knowledge Award in Basic Sciences (2017), the Wolf Prize in Chemistry (2018), the ENI Award for Excellence in Energy (2018), the Gregori Aminoff Prize by the Royal Swedish Academy of Sciences (2019), the August-Wilhelm-von-Hofmann-Denkmünze of the German Chemical Society (2020), and the Royal Society of Chemistry Sustainable Water Award (2020).

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