Materials Science & Engineering Seminar Series

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Growth and Electronic Properties of Heusler Epitaxial Thin Films

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ABSTRACT: Heusler compounds are an exciting family of ternary intermetallics that can be composed of elements from a large fraction of the periodic table. Their electronic properties are predicted to depend on the number of valence electrons per formula unit. In general, Heusler compounds form two main variants: half-Heuslers (XYZ) with the $C1_b$ crystal structure and full-Heuslers (X_2YZ) with the $L2_1$ crystal structure. They have been predicted and experimentally shown to exhibit novel electronic and magnetic properties, such as half-metallic ferromagnetism, semiconducting and superconducting. A number of half-Heusler compounds are predicted to be topological non-trivial insulators or semimetals and should display topological surface states, which would be useful for spintronic applications.
The half-Heusler compounds with composition XYZ can be thought of as being a zincblende structure of XZ with the Y atoms in the octahedral sites. The close similarity to the zincblende III-V compound semiconductors and the ability to adjust the lattice parameters of III-V semiconductors by alloying over the range of lattice parameters of many Heusler compounds makes III-V semiconductors a good choice as substrates for Heusler compound epitaxial growth.
In this presentation, I will emphasize the molecular beam epitaxial growth and properties of Heusler compounds grown on III-V semiconductors. Their application in spintronic devices will also be discussed.

BIOGRAPHY: **Chris Palmstrøm** is a Professor in the Electrical and Computer Engineering and the Materials Departments at the University of California, Santa Barbara. His research involves atomic level control and interface formation during molecular beam and chemical beam epitaxial growth of metallic compounds, metal oxides and compound semiconductors. He received his B.Sc. in physics and electronic engineering and Ph.D. in electrical and electronic engineering from the University of Leeds. After being a Lecturer in Norway and a Research Associate at Cornell, he joined Bellcore as a Member of Technical Staff in 1985. From 1994-2007 he was a Professor in the Department of Chemical Engineering and Materials Science at the University of Minnesota and in 2004 became the Amundson Chair Professor. In 2007 he joined the faculty at the University of California, Santa Barbara. He has pioneered dissimilar materials epitaxial growth studies using a combination of molecular beam epitaxial growth with in-situ surface science probes including STM, XPS and AES, and ex-situ structural and electronic characterization. An important aspect of his work has been to go beyond surface science and structural studies to make materials for device structures allowing for detailed electrical and optical measurements of materials and interfacial properties. Specific studies have emphasized metallization of semiconductors, dissimilar materials epitaxial growth, thin film analysis, and molecular beam and chemical beam epitaxial growth of III-V semiconductor heterostructures, metallic compounds, metal oxides, multifunctional, magnetic, thermoelectric, and spintronic materials, and superconductors. He is the author of 300+ publications, including five review chapters and research monographs. In 2015 he received the North American MBE Innovator Award and was made a DOD National Security Science and Engineering Faculty Fellow (now called Vannevar Bush Faculty Fellowship) and in 2018 the APS Adler Award. He is Fellow of AVS, APS, and MRS.

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