# Chris Palmstrøm

## "MBE Growth of Ferromagnetic Metal/Compound Semiconductor Heterostructures for Spintronics"

Electrical transport and spin-dependent transport across ferromagnet/semiconductor contacts is crucial in the realization of spintronic devices. Interfacial reactions, the formation of non-magnetic interlayers, and conductivity mismatch have been attributed to low spin injection efficiency. MBE has been used to grow epitaxial ferromagnetic metal/$Ga_{1-x}Al_xAs$ heterostructures with the aim of controlling the interfacial structural, electronic, and magnetic properties. *In situ* STM, XPS, RHEED and LEED, and *ex situ* XRD, RBS, TEM, magnetotransport, and magnetic characterization have been used to develop ferromagnetic elemental and metallic compound/compound semiconductor tunneling contacts for spin injection. The efficiency of the spin polarized current injected from the ferromagnetic contact has been determined by measuring the electroluminescence polarization of the light emitted from $Ga_{1-x}Al_xAs$ light-emitting diodes as a function of applied magnetic field and temperature. Interfacial reactions during MBE growth and post-growth anneal, as well as the semiconductor device band structure, were found to have a dramatic influence on the measured spin injection, including sign reversal. Lateral spin-transport devices with epitaxial ferromagnetic metal source and drain tunnel barrier contacts have been fabricated with the demonstration of electrical detection and the bias dependence of spin-polarized electron injection and accumulation at the contacts. This talk will emphasize the progress and achievements in the epitaxial growth of a number of ferromagnetic compounds/III-V semiconductor heterostructures and the progress towards spintronic devices.

Chris Palmstrøm received his Ph.D. in Electrical and Electronic Engineering from the Univ. of Leeds, U.K. He has served as a Research Fellow at Leeds; a Postdoctoral Research Associate at Cornell Univ.; a member of the technical staff at Bellcore; an Associate Professor, Professor, and Amundson Chair Professor of Chemical Engineering and Materials Science at the Univ. of Minnesota; and is currently Professor of Electrical and Computer Engineering and Materials at the Univ. 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 has pioneered dissimilar materials epitaxial growth studies using a combination of molecular beam epitaxial growth with *in situ* surface science probes including scanning tunneling microscopy, and x-ray photoelectron and Auger electron spectroscopies, and *ex situ* structural and electronic characterization. An important aspect of his work has been to go beyond surface science and structural studies to also 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 metallic compounds, metal oxides, functional materials, magnetic materials, spintronic materials, and compound semiconductors. He is a Fellow of both the American Physical Society and the AVS Science and Technology Society.

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### 3:00 p.m.

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