UNH Materials Science Seminar

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DeMeritt Hall 209B, University of New Hampshire

Role of a Materials Scientist and Engineer in High Tech Industry

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Northrop Grumman is a world leader in materials, devices and systems research. It is a leader in producing systems which cover everything from undersea to space. The role of the materials scientist and engineer is very complex. It involves solving the near-term problems and having great vision for the long-term improvements in materials and hence in devices and systems. During this talk examples of electro-optical and radio-frequency materials and their importance will be presented.

A microgravity experiment on the growth of mercurous chloride was designed and performed in the Space Experiment Facility (SEF) transparent furnace that was flown on Spacehab 4 (STS 77). Growth ampoules and cartridges were designed and fabricated to meet the science requirements. Two crystals were grown at the same time in the same furnace with <110> orientation. Both crystals appeared to have been growing nicely with convex interfaces when the experiment was interrupted. The Mission Specialist reported direct abstraction of growth facets on the growth unit during growth of the crystal faces of the crystals. The direct observation was made on the interface during the growth of crystals. Space grown crystals were characterized and compared with 1-g grown crystals by the X-ray method.

In the area of the nonlinear optical materials, it is clear that many military and commercial systems require systems requiring excellent beam quality, high power, and wavelength agility in a rugged, low weight system, which consumes little power. The combination of a tunable laser and a frequency converter, such as a second harmonic generator (SHG) or optical parametric oscillator (OPO) is a very effective method for satisfying these requirements. Over the past three decades several materials from the halides, chalcopyrite and chalcogenide class have been studied. Several methods including Bridgman and physical vapor transport (PVT) have been used to grow large crystals of these materials. In addition to these selenides, periodically poled lithium niobate has been used very frequently up to 4 μm wavelength. Periodically poled lithium niobate along with other oxides may not be suitable for mid- to far-IR wavelength region due to limited transparency and strong absorption. We have identified that the most promising class of frequency converter materials to cover a wide range of transparency is the binary halides. A detailed discussion on the growth and applications of single crystals of these materials will be presented.