Gd Eu Tb Sm Dy Pm Ho RARVS Nd Er Pr Tm Ce Yb La Sc Y Lu

Rare-earth Information Center Insight

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Yellow or Orange Emission from GaN

GaN is being investigated as a host material for RE-based electroluminescent devices (ELD) {*Appl. Phys. Lett.*, **76**, [12], 1525-7 (2000)}. In situ doped GaN:RE ELDS have exhibited emission in the three primary colors: green (Er^{3+}), red (Eu^{3+}, Pr^{3+}), and blue (Tm^{3+}). Now a single ELD has been fabricated from GaN thin films codoped with Er and Eu, which emits both yellow and green light that results from the green emission from Er and red from Eu. The color of the emissions varies from orange to yellow as the bias voltage is increased from 70 to 100 volts. Interestingly, color on increasing voltage is different from that observed when the voltage is decreased.

Frequency Conversion in Periodically and Aperiodically Poled RE doped $LiNbO_3$

A single laser crystal capable of simultaneously generating red, green, and blue light would be ideal for high brightness displays. In principal, such crystals are possible when a non-linear host crystal is used. The nonlinearity results in second harmonic generation. The problem is that several lasing processes are required, and they must be phase matched. If a ferroelectric crystal is used, an aperiodic distribution of domain reversals may facilitate the phase matching at the expense of peak efficiency. Recently, {*Appl. Phys. Lett.*, **76**, [10], 1225-7 (2000)} a Nd^{3+}-doped lithium niobate single crystal was used to obtain continuous laser oscillations in two laser channels in room temperature operation. What is interesting to the materials scientist is the manner in which the poling of the crystal was obtained. The crystal was grown by an off-centered Czochralski technique from a $LiNbO_3$ melt doped with Nd_2O_3. When the axis of the temperature gradient is offset from the growth axis, the ferroelectric crystal is "chirped", which apparently means there are ferroelectric domains in the sample with domain lengths of 3 to 7 μm. The paper has a micrograph showing the domains in the central part of the sample, and they are extremely regular. The ferroelectric domains, which are aperiodic in width, result in a spatially varying electric field within the sample. This results in a distribution of phase shifts for a photon passing through the sample and, hence, the lasing action is spread over a wider bandwidth. Thus, there is overlap between the requirements for lasing at two frequencies.

The same group has reported self-frequency doubling in periodically poled $LiNbO_3$:MgO bulk crystals doped with Yb^{3+} {*Appl. Phys. Lett.*, **76**, [11], 1374-6 (2000)}. The same technique is used as in the first paper, and it is not clear why in the first case the domains are aperiodic while in the second they are periodic. The second paper points out that since in the Czochralski technique the sample is rotated, if the rotation axis is not parallel to the temperature gradient, the rotation of the sample results in a periodically varying temperature gradient. This variation in the growth conditions results in periodic changes in the structure. For a solid solution compound, this may be periodic fluctuations in composition. This gives the chirped crystal and the periodic ferroelectric domains. The self-frequency dou-

bling resulted in green emission from the Yb^{3+} doped material.

E. Joel Calhoun, Cattle Rancher

For the past decade, Joel Calhoun has served the rare earth community through the *Rare-earth Information Center*. While most of you never met Joel, he has been the friendly, knowledgeable voice on the phone, who delivered expert help in formulating database searches and rapid service in supplying the results. Joel has also written the vast majority of the articles in the *RIC News*. Unfortunately, Joel has left the RIC for greener pastures, at least they are greener when it rains in western Nebraska. Joel is moving his family to the northwest corner of Nebraska where he and his wife are taking over her family's cattle ranch. Joel assures me that he will not be riding a horse and packing a six-gun, but he will be a cowboy on a four wheel ATV. Replacing Joel will not be easy and we ask your patience in the transition. While we deal with the complications of university hiring policy, I will be answering your questions and conducting literature searches. We will be accepting applications for Joel's position until mid April.

RIC Position

The Rare-earth Information Center (RIC) has an opening for a Communications Specialist. The communications specialist will provide information from the database to an international clientele, maintain the RIC database including the classification of scientific and technical papers by detailed keywords, and prepare the *RIC News*. A bachelor's degree with significant course work in chemistry, physics or materials science plus one year of related work experience is required. Experience should include materials classification by chemical composition, materials preparation and characterization, as well as experience in technical writing or as a technical service representative. (Appropriate graduate level course work in science, engineering or a technical writing field may be substituted for work experience). Excellent communication skills are required to communicate with US and international supporters and clients of the RIC. The ability to communicate easily with people whose first language is not English is essential. Familiarity with desktop publishing software is required.

Short Notes

Sumitomo Special Metals Ltd. has produced a Nd-Fe-B magnet with 55.8MGOe (444kJ/sq-m) energy product. In order to obtain this value, a sintered density of 99% was achieved with a polycrystalline orientation of 98%. The remanance is 95% of that for pure $Nd_2Fe_{14}B$. A commercial magnet, with an energy product of 53 MGOe, is scheduled for later this year. The new magnet is reported to have a maximum operating temperature of 200°C.

Researchers at Mitsubishi Materials Corporation and Oita University have investigated lanthanum gallate-type perovskite oxide ((La,Sr)(Ga,Mg,M)O) where M=Fe or Co, for use in solid oxide fuel cells. The material was used to produce a test-production fuel cell, which operates at 650°C with an output density of 3.57KW /m^2. The operating temperature is said to be compatible with fabricating the cell containers from steel, reducing the cost of the cells.

R. W. McCallum
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