MRS BULLETIN

December 1999

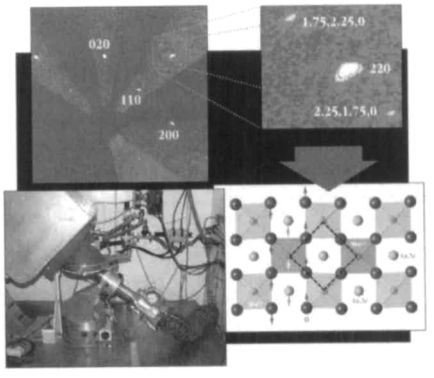
A Publication of the Materials Research Society
Volume 24, Number 12 ISSN: 0883-7694 CODEN: MRSBEA

NEUTRON SCATTERING IN MATERIALS RESEARCH

MRS NEWS

ABSTRACTS

DEPARTMENTS



ON THE COVER: Single-crystal neutron-diffraction data and the structure solution obtained for the charge-ordered phase of $LaSr_2Mn_2O_7$. **Bottom left:** The single-crystal neutron diffractometer (SCD) located at the Los Alamos Neutron Science Center. This instrument uses a Laue geometry that differentiates between different neutron wavelengths, using the time-of-flight technique. The sample is placed in a vacuum chamber (red sphere at center of image) and is attached to a displex refrigerator for cooling. Diffracted neutrons are measured in a 20 cm x 20 cm area detector that is placed in a shielded box (painted silver) above and to the left of the sample vacuum chamber. **Top left:** At a single setting of a single-crystal sample, the SCD can measure scattering from a volume of reciprocal space. By combining different settings, maps of reciprocal space can be constructed, as has been done for the layered manganite $LaSr_2Mn_2O_7$. This technique is especially useful in measuring diffuse scattering or searching for scattering phenomena throughout reciprocal space. **Top right:** In $LaSr_2Mn_2O_7$, the localization of electrons in alternate Mn sites resulted in weak superlattice reflections with propagation vector $\mathbf{q} = (h+1/4, k-1/4, l)$ at 160 K. Examples of these weak superlattice reflections (approximately 0.7% of the parent reflection) are clearly seen around the (220) reflection. **Bottom right:** By measuring approximately 700 weak superlattice reflections, the structure of $LaSr_2Mn_2O_7$ was determined. In this material, two Mn sites were discovered: one site (blue) where there is a pronounced in-plane distortion of the MnO_6 octahedron that signifies additional charge (Mn^{3+}), and the other (pink), which shows a significantly smaller distortion, suggesting less charge (Mn^{4+}). Images courtesy of D.N. Argyriou. For more information on neutron scattering, see the technical theme that begins on page 14.

https://doi.org/10.1557/S0883769400053604 Published online by Cambridge University Press

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MRS Bulletin (ISSN: 0883-7694) is published 12 times a year by the Materials Research Society, 506 Keystone Drive, Warrendale, PA 15086-7573. Periodical postage paid at Warrendale, PA and at additional mailing offices. POSTMASTER: Send address changes to *MRS Bulletin* in care of the Materials Research Society, at the address listed; phone 724-779-3003; fax 724-779-8313. Printed in the U.S.A.

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