12-Amorphous, Imperfectly Ordered and Quasi-periodic Materials

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THE IN SITU STRUCTURE OF L3 and L4 OF THE LARGE RIBOSOMAL SUBUNIT FROM NUCLEAR SPIN CONTRAST VARIATION

J. Zhao and H.B. Stuhrmann*
GKSS Forschungszentrum, W-2054 Geesthacht, Germany

Isotopic exchange of ^1H by its heavier isotope ^2H (=D) is a widely used method of neutron scattering in macromolecular structure research. Its power is greatly enhanced by using polarized neutron scattering from polarized nuclear spin targets. In collaboration with CERN and ILL we have set up a facility at GKSS which allows dynamic nuclear polarization and selective depolarization of protons and deuterons (Knop et al. 1991). The hydrogen isotopes therefore can be mapped separately.

The hydrogens of the large subunit of E.coli ribosomes were almost completely exchanged by deuterium and the protons were left in in one (or two) of its proteins only (Nierhaus, MPI Berlin). The unlabelled particle and the protonated derivatives protonated in L3, L4 and L3+L4 were investigated by polarized neutron small-angle scattering in the following states:

1) dynamically polarized, i.e. all spins polarized,
2) proton spins polarized only,
3) deuteron spins polarized only.

Using the basic scattering functions of the various targets together with the low resolution model of the large ribosomal subunit from electron microscopy yields the sites and shapes of L3 and L4 (Fig. 1) from the neutron scattering of the L3- and L4-derivative respectively. The data from the L3+L4 derivative confirm the results from the single derivatives.

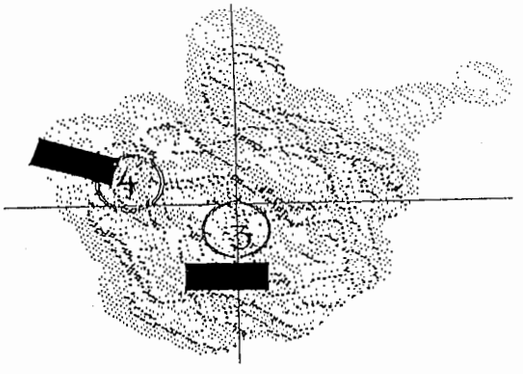

Fig.1) The ribosomal proteins L3 and L4 as located by nuclear spin contrast variation (▬) compared to the sites suggested by electron microscopy and cross linking (O). L3 and L4 have an asymetric shape, the nature of which is presently investigated in more detail (Stuhrmann, 1993). The model of the large ribosomal subunit is due to J. Frank.

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H.B. Stuhrmann (1993) Neutron News (submitted)

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STRUCTURAL CHARACTERIZATION OF GLASS IN THE In-Bi-Mn-B-O SYSTEM

Zhigang Zou, Mineralogical Institute, Faculty of Science, University of Tokyo, Hongo 7-3-1, Bunkyo, Tokyo 113, Japan.

In-Bi-Mn-B-o glasses were prepared by a quench method using a halogen arc-imaging furnace and their electrical conductivity was investigated. In order to obtain ideal glass phases, the samples were prepared by varying their compositions and temperature conditions. As results, ideal glass phases were obtained in the composition range of In_2O_3;20-50, Bi_2O_3;30-50, MnO_2;0-20, B_2O_3;0-10 (by mol%) with the Tg of 280~ 282℃ . The glass transition (Tg) and crystallization temperatures of the glasses decreased monotonically with increasing B content. The glass-ceramic body consisted of four types of crystalline phases with small grain size of 5~ 8 microns. The crystalline phases were mainly examined by SEM and X-ray diffraction technique. This work was mainly performed at the Research Laboratory of Engineering Materials, Tokyo Institute of Technolgy and the author greatly appreciates Professor Z. Nakagawa for his advice. .

PS-12.03.09 ELECTRON DIFFRACTION STRUCTURE ANALYSIS OF THIN AMORPHOUS FILMS. By A. S. Avilov, Institute of Crystallography of Russian Academy of Sciences

The presence of a series of valuable properties of amorphous thin films allows a detailed study of their atomic structure. The application of electron diffraction with subsequent construction of a structure model is the most perspective method of investigation of amorphous films.

Assignment of pair correlation functions ρ_{ij} which define a distribution of atoms of one kind around another kind is an important step in structure analysis of two- or more-component compounds. To solve of this problem a new method of its definition based on electron diffraction data is proposed. The main point of the method for the case of two-component substances is to measure the intensity distributions in patterns obtained with three different accelerating voltages. Three structure factors which are obtained by using the atomic amplitudes in partial waves approximation, form three mutually independent relations for the determination of ρ_{ij}-functions. The accuracy of experimental intensity measurements must be very high. In the case of insufficient accuracy it is possible to define of two ρ function instead of three (the third can be determined from known structure data, e.g. crystal data). The method is applied to structure investigation of amorphous film GeTe.

