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ABSTRACTS

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**TARAS SHEVCHENKO
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3D VELOCITY MAPPING WITH RHEO-NMR ACCESSORY

Uwe Eichhoff, Dieter Gross, Klaus Zick, Volker Lehmann
Bruker BioSpin GmbH, Silberstreifen, D-76287 Rheinstetten/Germany

NMR Imaging (MRI) has found widespread application in biomedicine and medical diagnostics. As an accessory for normal analytical NMR spectrometers it can be used for imaging on a microscopic scale in solid and liquid state. The velocity of flow in a liquid or viscous medium can be imaged in three dimensions. In a special RheoNMR accessory the sample can be placed under rheological stress inside the RF coil in an NMR magnet. A wide variety of shearing and extensional flow cells featuring different geometries are available. The cells are driven by a specialized motor and drive shaft assembly that is controlled by a dedicated hardware interface unit.

RheoNMR is making a major impact on studies of mechanical properties of complex fluids, including polymer melts and solutions, lyotropic and thermotropic liquid crystals, micellar surfactant phases, colloidal suspensions and emulsions, biological fluids, foods, and many fluids important in industrial processing and engineering.

Modification or replacement of the rheo cells by other mechanical structures allow investigations for the characterization of flow and mixing behaviour in a given stirring design, especially of optically opaque disperse media. The typical velocity range is between 0.1 mm/sec and 1000mm/sec. Mixing and demixing, for instance sedimentation, can be observed and the temporal evolution of chemical/physical reactions in process engineering can be analyzed, e.g. mash process or fermentation.

ON NONMONOTONIC RELAXATION PROCESSES IN NONEQUILIBRIUM AL-TM-REM MELTS

V.I. Lad'yanov^{1,2}, S.G. Menshikova^{1,2}, A.L. Bel'tyukov^{1,2}, M.G. Vasin^{1,2}, V.V. Maslov³

¹Physical-Technical Institute, Ural Division, Russian Academy of Sciences, 132 Kirov Str., Izhevsk, 426000, Russia

²Udmurt State University, Science Research Institute Thermophysics of New Materials, 1 Universitetskaya Str., Izhevsk, 426034, Russia

³G.V. Kurdyumov Institute of Metal Physics, National Academy of Sciences of the Ukraine, 36 Vernadsky's Avenue, Kyiev-142, UA-03680, Ukraine

In the present paper the measuring of the temperature and time dependences of kinematic viscosity of liquid Al-Y (up to 10 at.% Y), Al₈₇Ni₈Y₅, Al₈₆Ni₈(Ce/La)₆, Al₈₆Ni₆Co₂Gd₄(Tb/Y)₂ alloys was carried out by the method of damped torsional vibrations.

An irreversible non-monotonic change of the melts viscosity above the temperature of melting brought about by the destruction of their microheterogeneous state inherited from the multi-phase solid sample has been found out. It is shown that for the melts transition into the quasi-equilibrium state long isothermal holding is necessary. At the temperatures close to the melting temperature the relaxation times are order of 300 minutes. The relaxation time decreases with increase of the melt temperature.

On the basis of the conception about of a micronon-uniform structure of melts in view of the ultrametric dynamic theory of a molecular field [1] the model of a nonmonotonic relaxation of the nonequilibrium melts has been offered. According to the offered approach, the key parameter, which influences viscosity, is the concentration of nonequilibrium microgroups of atoms. In the beginning of isothermal holding of melt the size of these microgroups is great enough, but their concentration is small and does not render essential influence on viscosity. Eventually the concentration of these microgroups is changing. That is determined by two processes: dissolution the largest and dispersion the finest of microgroups. The first process (that is dissolution) leads to increase in concentration of nonequilibrium microgroups in melt, the second (that is dispersion) leads to reduction of their total. Joint influence of these two processes is shown in nonmonotonic change of viscosity investigated melts.

[1] Vasin M.G., Ladyanov V.I. Description of anomalous features in viscosity polytherms of melts as «sol-weak gel» - like transition in terms of ultrametric dynamic theory of molecular field // Thirteenth International Conference on Liquid and Amorphous Metal. Book of Abstracts. – Ekaterinburg, 2007. – P.147.