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SCATTERING METHODOLOGY – INSTRUMENT COMPONENTS

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In the contribution **Morphology of Glass Surfaces** by P.Böni, D.Clemens, H.Grimmer and H.Swygenhowen (ETH Zürich and PSI), **Peter Böni** impressively showed the effort which had gone in the past years into the improvement of the performance and reproducibility of supermirrors. He presented the results of reflectivity measurements of supermirrors using four different types of glasses. In 385 runs with all together 90 m^2 of supermirrors it was found that the reflectivity depended on the type of glass but was fairly reproducible for each type. The average reflectivities varied from $<R> = 86.6$ % for polished Calcite, $<R> = 86.8$ % for float Ni–guide (this type showed the largest data scatter from about 82 % to 92 %), $<R> = 88.1$ % for polished Borkron to a remarkable $<R> = 91.1$ % for float glass from a local supplier. Interestingly, in this latter case with glass batches purchased over a period of 10 months from the same supplier, the results were consistently reproducible at this high level. Another important performance aspect discussed was the dependence of the reflectivity on the critical angle. It was found that for a supermirror aimed at a critical angle of four times that of Nickel ($m = 4$), the reflectivity decreased from about 1 for $m = 1$ to acceptable 0.7 for $m = 3$, whereas it was down to 0.3 at $m = 4$. It was therefore concluded that in this case a much better glass quality is required.

In a talk on **Remanent Multilayers for Polarized Neutron Instrumentation** presented by **Daniel Clemens** (ETH Zürich and PSI), after remarks on the history of FeCo mirrors and the problem of matching the scattering length densities, it was shown that by using non–stoichiometric $Ti_{1-x}N_x$ the scattering length for $|\downarrow\rangle$ – neutrons in magnetized $Fe_{0.5}Co_{0.48}V_{0.02}$ could be matched. On this basis a supermirror could be fabricated which had a number of useful properties such as a high reflectivity of 87 % at 2.1 times the critical angle of bulk Nickel and a flipping ratio $R > 40$. It was found that these supermirrors are operational in zero field, which were important for neutron spin echo application. No clear evidence for 'magnetically dead' layers in these multilayer structures was found. Furthermore, they are thermally stable, i.e. no interdiffusion of the layers are to be expected. SQUID hysteresis curve measurements with a 28 nm $Fe_{0.5}Co_{0.48}V_{0.02}$ film, which was produced by stationary sputtering with oblique incidence of the sputtered particles, showed that a 'hard' magnetization was obtained.

Laszlo Cser (RISSP Budapest) contributed **Three Remarks on Wide Band Devices.** Firstly, he proposed a much broader use of supermirror (SM) guides for source utilization in order to more efficiently exploit the precious neutrons. With SM guides it were much easier to multiply use the individual beam holes due to the possible wider lateral instrument separation. Then he presented and advocated a proposal of Y.M.Ostanevich and Y.Y.Nikitenko (Dubna) for a wide–spectrum polarizer for pulsed sources on the basis of a set of rotating magnetized mirrors. The main feature of such a device is a sequence of differently inclined mirrors passing a beamhole, whereby neutrons of different wavelengths are reflected according to their time of flight. Technically the device might resemble a mechanical velocity selector or a set of conical tubes of different diameters assembled on a common axle. A possible advantage of these moving polarizing devices ($P \simeq 0.9$, $T = 0.5$) might be the higher overall polarization in a set–up with polarization analysis after the sample ($P_{eff} \simeq 27$ %) as compared to a polarizer/analyzer system consisting of ^3He components only ($P \simeq 0.3$, $T = 0.5$, $P_{eff} \simeq 10$ %). Finally the use of statistical choppers at pulsed sources was discussed for a better source utilization in trying to separate weak inelastic lines from nearby strong elastic contributions.

A talk on the recent development within the EU–sponsored NEREIDE collaboration of **Two–dimensional Neutron Detectors** was given by **Roland Gähler** (TU München). He presented the effort in selecting the adequate scintillator material from choices with widely varying and partly unwanted properties (γ–sensitivity, quantum yield, hygroscopicity etc.). A ^6Li–glass now seems to be superior to the formerly used hygroscopic ^6LiJ. It was impressive to see the enormous progress in improving the spatial resolution of the two–dimensional detectors, which is particularly important for neutron radiography. As a lucid example the radiographic picture of a small electric motor was shown displaying minute details. An example of a set–up was presented, where the light from the scintillator was reflected from a mirror into the camera in order to get out of the direct radiation field. The difficulties with the readout of the CCD cameras were pointed out in this context, which are due to the fact that the size of the image within the camera is of the order of 1 cm^2 only.

The final contribution on **Sputtering Method for Improving Composite Germanium Monochromators** by G.Böttger, A.Dönni, P.Fischer, S.Fischer, M.Koch, M.Medarde, J.Schefer, U.Staub and R.Thut was presented by **Jürg Schefer** (ETH Zürich and PSI). After some remarks on the reasons for using Germanium as a monochromator and the necessity to enlarge the mosaic spread of natural Ge crystals for use in high resolution powder as well as single crystal diffractometers, the audience was reminded that the demanded mosaic spread can only be achieved by forming stacks of properly treated wafers. The slow and complicated bending and flattening procedures in a vacuum furnace generating the necessary lattice defects in the wafers and the cleaning, sputtering and soldering steps were explained. It was pointed out that, in further developing the method originally introduced at Brookhaven, the replacement of the tin foils by sputtered material as a soldering agent sandwiched between the wafers considerably improved the alignment of the individual wafers. Good neutron results and a constant quality of the produced composite monochromators were obtained at the cost of an extensive manpower.