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Microbeam-SAXS analysis on aqueous colloidal dispersions of nanosheets with extremely high aspect ratios

D. Yamaguchi[1], N. Miyamoto[2], T. Nakato[3], S. Koizumi[4], N. Ohta[5], N. Yagi[5], T. Hashimoto[6] and T. Kawakatsu[7]

[1]QuBS, JAEA, Tokai, Japan, [2]Fukuoka Inst. Tech., Fukuoka, Japan, [3]Kyushu Inst. Tech., Fukuoka, Japan, [4]Ibaraki Univ., Ibaraki, Japan, [5]JASRI, Hyogo, Japan, [6]Kyoto Univ., Kyoto, Japan, [6]Tohoku Univ., Miyagi, Japan

E-mail: yamaguchi.daisuke@jaea.go.jp

Self-assembled structures of aqueous colloidal dispersions of niobate nanosheets having a uniform thickness of d = 1.6 nm and an average lateral dimension of $\overline{L}$ = 650 nm, hence an extremely large nominal aspect ratio ($\overline{L}/d$) of ~400 were studied by small-angle neutron scattering (SANS) and micro-beam synchrotron small-angle x-ray scattering (SAXS). The results elucidated highly orientated, periodic layered liquid crystalline (*LC*) phase exhibiting a multiple-order scattering peaks up to more than fifth-order. The line-profiles of the multiple-order peaks were quantitatively analyzed in the directions both parallel and perpendicular to the one-dimensional stacks of the nanosheets for each order of the peaks. The results were quantitatively compared with fluctuation theories developed based on the Peierls-Landau instability [1-3]. We will present a theoretical problem concerned with undulation modes of the sheets and an experimental problem associated with effects of orientation distributions of the stacks on the line profile analyses.

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