o.m8.p1 **Temperature Dependent X-Ray Stress Analysis on MBE- Grown GaN- Films On Sapphire.** B. Sonderegger[1], J. Keckes[2], G. Leising[1], R. Resel[1]. [1]*Institut für Festkörperphysik, Technische Universität Graz, Petersgasse 16, A- 8010 Graz, Austria.* [2]*Erich Schmidt-Institut für Materialwissenschaften, Österreichische Akademie der Wissenschaften and Institut für Metallphysik; Montanuniversität Leoben, Austria.*
Keywords: high temperature, stress analysis, GaN.

At the MBE production process of thin GaN layers on single crystalline substrates the films grow at a temperature of more than 1100K. After cooling down at room temperature stresses parallel to the surface of the layer are inducted due to the different coefficients of thermal expansion from the GaN- layer and the sapphire substrate. Temperature dependent X-ray stress analysis arises the opportunity to measure these stresses directly.

Two samples of a 2µm thick GaN film on a sapphire substrate were measured on a Phillips X'Pert System ATC3 Texture Cradle, which was additionally provided with a high temperature attachment with integrated temperature controller. To determine the coefficientes of expansion in different angles, 6 peaks of the layer and 3 peaks of the substrate were measured in an area of ψ=0 to 70°. The peaks were measured at temperatures from 300K to 850K in steps of 100K. To make sure the effects are reversibel the measurements were repeated by cooling the sample down again.

In each direction a constant linear temperature coefficient of expansion could be detected. The expansions were also linear in $\sin^2(\psi)$ at constant temperatures, only stresses parallel to the surface occured. Additionally these stresses were dependent on the φ- direction. So the result of the measurements can be summed up in a 2-dimensional stress tensor $\sigma(T)$. The effects were fully reversible, the interconnection between GaN film and substrate was not damaged.

o.m8.p2 **X-ray diffraction line broadening by stacking faults in $SrBi_2Nb_2O_9/SrTiO_3$ epitaxial thin films.** A. Boulle[a], C. Legrand[b], R. Guinebretière[a], J.P. Mercurio[b], A. Dauger[a], *Science des Procédés Céramiques et de Traitements de surface, CNRS UMR 6638. a ENSCI, 47 à 73 av. Albert Thomas 87065 Limoges Cedex, France b Faculté des sciences, 123 av. Albert Thomas 87060 Limoges Cedex, France.*
Keywords: X-ray diffraction, line profile analysis, Aurivillius compound.

Layered bismuth oxides thin films are of great interest for non-volatile random access memory applications because of their excellent resistance to polarisation fatigue. $SrBi_2Nb_2O_9$ (SBN) is an Aurivillius compound[1] made of the stacking along the c axis of $SrNb_2O_7$ "perovkite like" blocks separated by Bi_2O_2 slabs. SBN thin films were deposited on (001) $SrTiO_3$ substrate by sol-gel spin coating. A previous study[2] showed that the film crystallises with c-axis normal to the surface. Those epitaxial films were studied by means of X-ray diffraction (XRD) line profile analysis as a function of thermal annealing duration. The experiments were carried out on a high resolution XRD laboratory equipment[3,4].

The line profile analysis of the diffraction patterns collected in ω-2θ scan mode[5], give detailed information on the coherently diffracting domain size and microstrains along a given direction. For low annealing duration the width of the (00l) diffraction lines reached values around 1°. Recently we studied stacking disorder in SBN powders. In accordance with this study[5], integral breadth and Fourier analysis suggest the presence of stacking faults (i.e. a local variation of the number of perovskite layers) separated by a mean distance of 7 nm. The profiles exhibited a marked Lorentzian character as expected from a faulted crystal[6]. In addition to faulting, both finite grain size and microstrains contribute to the observed width.

When heat treatment time is increased the breadth and Lorentzian content of the (00l) diffraction lines decrease attesting that stacking fault density is lowered. For 500 h treatment at 700°C the calculated domain size equals the films thickness which indicates that stacking faults have almost disappeared : the SBN phase has reached an equilibrium state.

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