phase-specific domain wall configurations [1], and hence, reorientations occur during thermal cycling. This feature may be of practical use as the preparation of electrolyte and electrode ceramics for SOFC includes compaction during one of the synthesis stages. Ceramics of LSGM can be approximated by an ensemble of small crystallites. Mechanical pressure imposed to such an electrolyte pellet causes the rearrangement of the twin structure of “chevron cells” in ceramic grains along the direction parallel or nearly parallel to the imposed pressure. Hence, such pressure will cause memory texturing of twin “chevrons” in electrolyte layers along the direction of oxygen diffusion in the SOFC structure. Keeping in mind the influence of twin walls on the conductivity and the high density of twin walls in LSGM solid solutions, it is supposed that texturing of the twins, e.g. reorientation of “chevron cells” increases the conductivity of the perovskite-type electrolyte LSGM along the cathode-anode direction.

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Keywords: twin structure, ionic conductivity, electrolytes

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A new model of localized plastic flow and failure of solids.

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Plastic flow localization was investigated on the micro- and macro-scale levels. Localization behavior was examined for a range of metals and alloys that differ in chemical bond and crystal lattice type (BCC, FCC, HCP, tetragonal and monoclinic), in structural state (single- or polycrystal, nanostructure, amorphous) and in deformation mechanism type (dislocation glide, twinning, martensitic transformation) [1]. It was established that deformation localization has the following regular features.

- Macro-scale plastic deformation tends to localize from microplasticity to viscous fracture stage.

- Four types of macrolocalization patterns are observed for yield plateau, linear and parabolic work hardening and prefracture stages.

- These patterns are regarded as different versions of self-excited wave generation.

- Significant variations in material structure and microstructure entail certain quantitative changes in localization patterns; however, their distinctive features remain intact.

- A correspondence rule is formulated, which holds that pattern type is determined by work hardening law acting at a given flow stage.

General regularities are discussed for plastic flow processes. On the base of this evidence a new plastic flow model is proposed the main assumption of which is that the regular features exhibited by the deformation behavior of a crystal are due to the interaction between its dislocation subsystem and acoustic emission pulses caused by dislocation shears.

It is shown that during material form changing, the deforming system would spontaneously separate into deforming volumes that alternate with those remaining undeformed at a given instant of time. Localization nuclei distributions tend to evolve in space and with time. Their evolution can be treated as self-organization manifested in terms of self-excited waves of different types generated in open systems. The separation of a medium into individual volumes and its self-organization involving interaction of its dislocation subsystem with acoustic emission impulses are of equivalent status. Moreover, the emergence of localized plasticity patterns is found to entail a decrease in the entropy of the deforming system. It is thus maintained that plastic flow macrolocalization can be addressed in the context of self-organization approach.

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Keywords: plasticity, wavelength, localisation

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TEM-based electron energy loss spectroscopy of (In,Ga)N/GaN heterostructure nanowires: influence of strain and composition.

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Wide-band gap materials basing on GaN are already commercially exploited for light emitting devices. (In,Ga)N/GaN heterostructures are fabricated as quantum wells or quantum dots. Up to now, axial heterostructure nanowires (NWs) were generated mostly via lithographic approach starting from quantum wells. We report on axial (In,Ga)N/GaN heterostructure NWs grown catalyst-free by plasma assisted molecular beam epitaxy on (111) silicon.

In addition to optical characterizations, transmission electron microscopy (TEM) investigations were performed. Cross-section samples were elucidated in a TEM/STEM JEOL 2200FS operated at 200 kV. Analytical TEM and in particular electron energy loss spectroscopy (EELS) was applied to characterize the (In,Ga)N nanodisks embedded in GaN NWs.

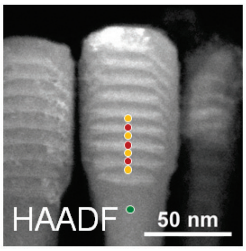

Fig. 1: High-angle annular dark-field image of the (In,Ga)N nanodiks embedded in GaN NWs. The spots mark the position of EELS measurements shown in Fig. 2. Red corresponds to (In,Ga)N and yellow to GaN. At the green spot the reference spectrum for GaN was acquired.

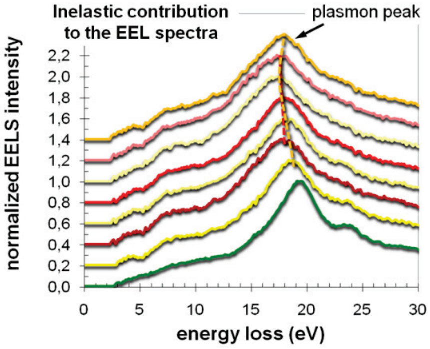

Fig. 2: Low loss EELS of the active region of the NW. The zero loss peak is subtracted. The arrangement of the spectra corresponds to the markers in Fig. 1.

The different nanodisks depicted in Fig. 1 exhibit a distinct variation of the energetic position of the plasmon peak as shown in Fig. 2. The correlation with both, the composition and the strain due to the lattice mismatch between (In,Ga)N and GaN will be discussed. In addition, the electron near edge fine structure of the nitrogen K-edge will be compared for both types of layers regarding the next neighbors of nitrogen being either only Ga (for GaN) or Ga and In (for (In,Ga)N).

Keywords: (In,Ga)N-based nanowires, electron energy loss spectroscopy, strain