

is known to be precipitated from glass phase, we got glass ceramics with high Q_f . In this paper, phase relations in the glass ceramics are examined by powder X-ray diffraction patterns.

Powders obtained from glass melted at 1550 °C are crystallized for 10 h at 1200, 1300 and 1400 °C, and for 50 h at 1200 °C. The powder diffraction data are collected with the multiple detector system on beam line BL4B2 at the Photon Factory in Tsukuba (Toraya *et al.*, 1996). As corundum phase are precipitated in all samples, it was used for internal standard. These samples are analyzed by Rietveld method using RIETAN-FP by Fujio Izumi. Initial atomic parameters for indialite, cordierite and corundum are sited from ICDD-PDF4+ cards.

Sample #1: 1200 °C, for 10 h was analyzed by two models: (1) Indialite + Corundum, and (2) Cordierite + Corundum. As 100 - diffraction peak profile of indialite shows slight asymmetric, it was considered that the symmetry of indialite becomes lower. But model (2) has a 311-diffraction peak which was not observed in the diffraction pattern. So, this crystal structure is similar to indialite, and cordierite percentage ρ is 3.5 %. Sample #2: 1300 °C for 10 h was analyzed by four models: (1) Indialite + Corundum, (2) Cordierite + Corundum, (3) Indialite + Cordierite + Corundum, and (4) Cordierite I + Cordierite II + Corundum. In the case of model (3), the fittings of some reflections were not sufficient. So, two cordierite I and II with different lattice parameters are applied. The cordierite percentage ρ is 32.5 %. Sample #3: 1400 °C for 10 h was analyzed by three models: (1) Cordierite + Corundum, (2) Indialite + Cordierite + Corundum, and (3) Cordierite I + Cordierite II + Corundum. In the case of model (3), the cordierite percentage ρ is 83.3 %. Sample #4: 1200 °C for 50 h was analyzed by three models: (1) Indialite + Corundum, (2) Cordierite + Corundum, (3) Indialite + Cordierite + Corundum. In the case of model (3), the cordierite percentage is 21.2 %.

Here, cordierite percentage $\rho = (a/\sqrt{3}b-1)/(17.0448/9.7127\sqrt{3}-1)$, a and b : lattice parameter of cordierite obtained, $a=17.0448$ Å, $b = 9.77605$ Å, and $c = 9.34498$ Å are lattice parameters of pure cordierite [ICDD-PDF#01-089-1487].

The cordierite percentage increases according to temperature and crystallizing time. And the quality factor Q_f is depending on the indialite (with high symmetry) percentage $1-\rho$. High symmetry affects to Q factor more than ordering.

Keywords: millimeterwave microwave dielectrics, indialite and cordierite, rietveld refinement

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Phase formation in deformed iron-based alloys under saturation by N and C

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The diffusion saturation of iron-based alloys by nitrogen and carbon is widely used in industry for increase of strength, hardness, wear and corrosion resistance of metal products. Inexhaustible and unrealized potentialities of such treatment are opened when applying it under strain and stress condition [1]. The topical question in this direction is clarification of mechanisms of N and C diffusion and phase formation in strained iron and iron-based alloys.

The structure, phase composition and properties of surface diffusion layers formed in the preliminary deformed α -Fe and Fe-Cr, Fe-Ti, Fe-Cr-Ti, Fe-Ni alloys after diffusion saturation by N and C were studied. Preliminary plastic deformation (PPD) was realized by rolling with deformation degrees: $\varepsilon = 3, 5, 8, 10, 15, 20, 25, 30, 35, 40, 50, 60,$

70 %. The following gaseous saturation with nitrogen and carbon was performed from ammonia and propane-butane at $T = 623\div 853$ K.

According to the SEM, TEM, XRPD investigations the diffusion layer is a combination of surface layers of different nitride (ξ -, ε -, γ' -) phases, nanostructured ($\gamma' + \varepsilon$) - eutectoid layer and a zone of internal saturation ($\alpha_{N,C}$ -phase with *bcc* structure). According TEM the eutectoid consists of γ' -phase (*fcc* structure with lattice parameter $a=0.378\pm 0.004$ nm) and ε -phase (*hcp* structure). The lattice constant of the α -solid solution of N in Fe is $a=0.286\pm 0.004$ nm.

PPD considerably effects on the phase formation, structure, microhardness and thickness of nitrided layers. The thickness of ε -phase layer depends on deformation degree and changes in the range of 25-43 μm . The nitrided layers formed in Fe-Ni alloys some differ from those in α -Fe. These differences consist in the presence of additional layer of ξ -phase on the surface. The diffusion layers in Fe-Cr-Ti alloys consist of a surface layer of ε -phase ($\text{Fe}_{2,3}\text{N}$ type) with hexagonal lattice or θ -phase with orthorhombic lattice isostructural to cementite (Fe_3C type) crystal lattice and a zone of solid solution of nitrogen and carbon in α -phase.

The distribution of carbon and nitrogen atoms in Fe after deformation and nitriding were studied using Mössbauer spectroscopy. An analysis of the hyperfine parameters has shown that the NGR spectra consist of several components relating to iron atoms in α -Fe and iron nitrides (ε -, γ' -phases).

The microhardness test of nitrided layers has discovered the narrow intervals of deformations of 3-8 % and 20-30 % in which the considerable rise (in about 2 times) of microhardness of the surface diffusion layer after nitriding of α -Fe exist. The high microhardness of the diffusion layers results from the formation of the ε - and γ' -nitrides. Iron doping with Ni leads to changing of the ε -, γ' -phases composition.

[1] L. Demchenko, S. Sidorenko, *Defect and Diffusion Forum* **2011**, 309-310, 155-160.

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Structure types of intermolecular tin halide interactions in diorgaotin dihalides

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