

**07.9-04** CRYSTAL STRUCTURE OF A NEW CERAMIC LANTHANUM SILICON NITRIDE,  $\text{LaSi}_3\text{N}_5$ . By Z. Inoue\*, T. Sawada\*\*, K. Ohsumi\*\*, M. Mitomo\* and R. Sadanaga\*\*, (\*) Nat'l Inst. for Research in Inorganic Materials, Namiki 1-1, Sakura-mura Niihari-gun Ibaraki 305, Japan, (\*\*) Mineralogical Inst. Faculty of Science, Univ. of Tokyo, 3-1 Hongo, 7-chome, Bunkyo-ku, Tokyo 113, Japan.

Silicon Nitride and its derivative materials are useful for high-temperature engineering applications because of their high decomposition temperature and excellent thermal shock resistance. The  $\alpha$ - and  $\beta$ - $\text{Si}_3\text{N}_4$  consist of fundamental structural units of  $\text{SiN}_4$  tetrahedra formed by sharing corners in three dimensional net work. SIALON is composed of the fundamental unit of  $(\text{Si}, \text{Al})(\text{O}, \text{N})_4$  tetrahedra (Jack, J. Mat. Sci. (1976) 11, 1135). The electrical neutrality in the SIALON is maintained by the partial replacement of silicon by aluminium and by the replacement of nitrogen by oxygen.

In this paper, crystal structure of new nitrogen ceramic  $\text{LaSi}_3\text{N}_5$  is reported and discussed. The space group is  $P2_12_12_1$ ,  $Z=4$ ,  $a=7.838\text{\AA}$ ,  $b=11.236\text{\AA}$ ,  $c=4.807\text{\AA}$  and  $D_c=4.6\text{g/cm}^3$ .

The lanthanum atom is located in the centre of two pentagonal holes composed of 5  $\text{SiN}_4$  tetrahedra joined by sharing corners. In this structure, some of the nitrogen atoms are each co-ordinated with two silicon atoms and two lanthanum atoms rather than three silicon atoms. Electrical neutrality is maintained by these nitrogen atoms co-ordinating with lanthanum atoms instead of by the partial replacement either of silicon with aluminium or of nitrogen with oxygen. This is the first example of a nitrogen ceramic in which a large size metallic atom is located interstitially in a large structural hole without any replacement according to the  $(\text{Si}, \text{Al})(\text{N}, \text{O})_4$  tetrahedra theory.

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**07.9-05** COBALT CYANOaurate: CRYSTAL STRUCTURE OF A COMPONENT IN COBALT-HARDENED GOLD ELECTROPLATING BATHS. L. E. Zyontz, S. C. Abrahams and J. L. Bernstein,\* Bell Laboratories, Murray Hill, New Jersey 07974, U.S.A.

The addition of cobalt ions to plating baths of  $\text{KAu}(\text{CN})_2$  solution can increase the hardness of the resulting electrodeposited gold finish by a factor of about two, as required for the successful production of connectors and contacts in the electronics industry. At high concentrations,  $\text{KCo}[\text{Au}(\text{CN})_2]_3$  precipitates from the plating bath: recrystallization from water at 360K gives  $\text{Co}[\text{Au}(\text{CN})_2]_2$ . The structure of the former has been published [Abrahams, S. C., Bernstein, J. L., Liminga, R. & Eisenmann, E. T. (1980). J. Chem. Phys. 73, 4585].  $\text{Co}[\text{Au}(\text{CN})_2]_2$  is hexagonal, with space group  $P6_422$ ,  $Z=6$ , and  $a=8.449(5)$ ,  $c=20.721(15)\text{\AA}$  at 298K. The integrated intensities of 12 037 reflections in reciprocal space with  $(\sin\theta)/\lambda \leq 0.89\text{\AA}^{-1}$  were measured with a CAD-4 diffractometer, resulting in 717 symmetry-independent nonzero structure factors. The crystal structure was solved by use of Patterson and Fourier series and refined by the method of least squares, with final  $R=0.0358$ ,  $wR=0.0516$ , and  $S=0.492$ . The  $\text{Au}(\text{CN})_2$  ion is close to linear, with C-Au-C angle =  $173.1(1.5)^\circ$  and Au-C =  $1.999(32)$ ,  $2.004(19)\text{\AA}$ , C-N =  $1.120(39)$ ,  $1.125(25)\text{\AA}$ . The  $\text{Co}^{2+}$  ion is tetrahedrally coordinated, with two Co-N distances of  $1.963(18)\text{\AA}$  and two of  $1.986(20)\text{\AA}$ , in contrast to the octahedral coordination in  $\text{KCo}[\text{Au}(\text{CN})_2]_3$  with Co-N =  $2.124(10)\text{\AA}$ . Possible roles of  $\text{Co}[\text{Au}(\text{CN})_2]_2$  and  $\text{KCo}[\text{Au}(\text{CN})_2]_3$  in inhibiting grain growth and hence hardening the electrodeposited gold layer will be discussed.

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**07.9-06** X-RAY INVESTIGATION OF COBALT AMPHIBOLE ASBESTOS. By T.I. Shishelova, L.V. Tchilkanova, E.A. Tchaikina. Department of Metallurgy, Polytechnical Institute, Irkutsk, USSR.

Cobalt amphibole asbestos obtained by hydrothermal synthesis has been studied with X-rays. High temperature investigation has shown that the products of thermal decomposition of Na-Co-amphibole are enstatite and an amorphous mass. Correlations between the strength, thermostability and texturing of asbestos papers have been noted. The mechanism of strengthening and texturing of asbestos papers is considered. The data obtained by X-ray diffraction and infrared spectra testify to the increase of the number of hydroxyls, which intensifies interaction of asbestos fibre with talc.