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Optical Properties Of Crystal Materials

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Annotation: The optical properties of quartz crystal, their natural and artificial types, optical radiation spectra are given.
Key words: crystal, mineral, structure, quartz, diamond, emerald, piezoquartz, fluorite, radiation-optical property, phase.

Introduction: In the Institute of Nuclear Physics under the Academy of Sciences, which is considered the center of natural sciences in Uzbekistan, a school of gemological scientists named after Vahidov was established. In this school, the growing and synthesizing of gem-crystal materials, checking their structure, rational-optical properties, determining their fields of use in economy and science are solved in this school.

Keynote: People have valued stone jewelry in the past. Rare stones cut by jewelers gradually turned into zebu - jewelry, and were seen as a measure of wealth. Many legends and stories are woven about precious stones such as diamond, ruby, gem, emerald, lapis lazuli, topaz, opal. Sometimes they are considered to be a symbol of happiness in life, a means of healing patients from various diseases. [1].

Figure 1. Natural quartz minerals are rock crystal and amethyst.

They were worn as amulets to bring victory in military campaigns. Stones are valuable because they are durable, resistant to the effects of various conditions, and can be polished and polished in sunlight. Now these stones are the most necessary raw materials in various sectors of the national economy. Ruby, yttrium aluminum - garnets are widely used as laser crystals [2], pesoquartz is used in radio electronics [3], and diamond is widely used in mining drills and chisels. The rapid growth of demand for rare stones has forced experts to study the modeling of natural processes. As a result, artificial diamond, ruby, quartz, turquoise, malachite, sapphire, alexandrite and dozens of other stones were artificially synthesized [4]. Minerals with a

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new structure that are not found in nature have been created, surpassing natural ones in terms of their properties. In particular, a quartz crystal with a beta structure was grown on a radiation basis, i.e., on the basis of seeds irradiated with neutrons (Fig. 2).

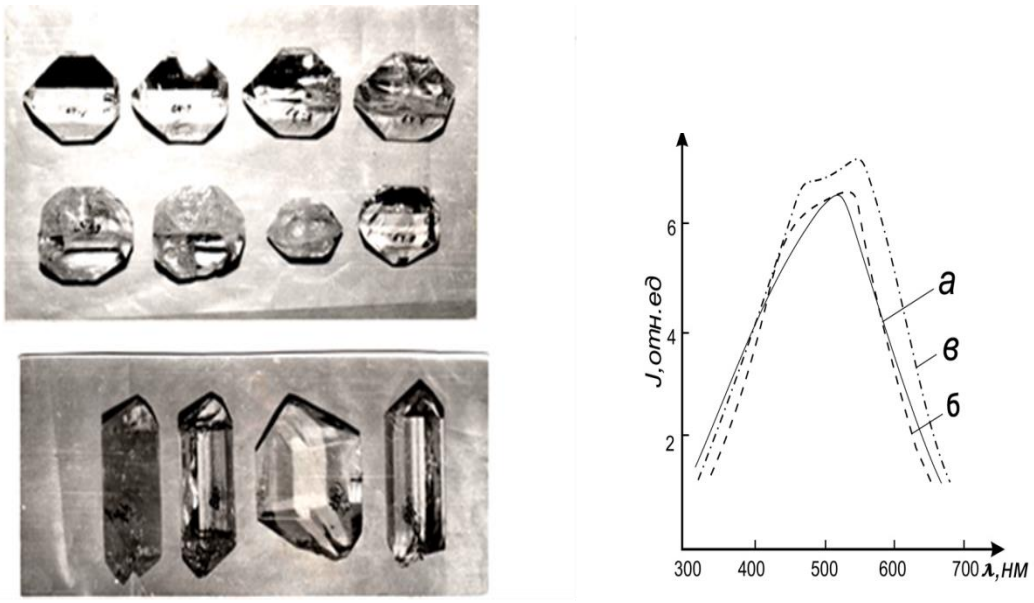

Figure 2. Synthetic quartz crystals grown on neutron-irradiated seeds and their gamma-luminescence spectrum.

Unlike the alpha phase of this crystalline quartz, which has a trigonal structure, it does not exist in nature under normal conditions and has a hexagonal (six-sided) unit cell. Pure quartz is colorless-clear (Figure 1). None of the other minerals can polish in as many and varied colors as quartz. Lenses and diamond-like jewelry are made from a type of quartz called rock crystal. Amethyst is a purple quartz (Fig. 1) containing iron, which is preferred over ruby. It is considered to be a symbol of strength and intelligence. Artificial amethyst, other colored quartzes and diamonds are also being synthesized in Aleksandrov, Russia [4,5]. Smoky black - "nightstone" - morion is also an aluminized type of quartz, from which jewelry such as pendants, rings, and ring eyes are made. Citrine is a yellow-lemon type of quartz, aventurine is brown, chalcedony, and agates are types with a hidden crystal structure [1].

Scientific research on the properties of fluorite-type crystals, their structure, and the state of their iron elements after dissolution was carried out using the methods of Mössbauer spectroscopy and standing X-ray waves [6]. The radiation-optical properties of the examined fluorite-type crystals are studied in the scientific laboratories of the Institute of Nuclear Physics of the Federal Republic of Uzbekistan [7-9]. The team of the Jizzakh Polytechnic Institute and the Institute of Nuclear Physics of the UzRFA, in cooperation with the scientific staff of SamSU, are conducting scientific research in order to check the unknown properties of jewels, which are considered the most necessary raw materials of science and technology. As a result of this cooperation, four candidate's and one doctoral theses were successfully defended in the solid state physics scientific laboratory of JizPI. These days, young science-hungry specialists of the "Physics" department of JizPI are conducting scientific research as independent researchers in cooperation with the scientists of the Faculty of Physics of SamSU. Scientists working in the leading scientific centers not only of our country, but also of the world were interested in the results of these scientific works.

Conclusion: If we say that there is a sea of works performed by jewelers, we have thought about only a drop of it. "To understand the essence of things, we need to know their origin," said the great thinker Aristotle. Just as science is as infinite as the universe, so are problems such as the structure, properties, origin, and artificial

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cultivation of gems - crystals. Solving these problems is a sacred task that must be solved before the talented, creative, talented youth of our independent country.

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