# High pressure study of langasite $Ba_3TaFe_3Si_2O_{14}$ up to 60 GPa and low temperatures

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Langasite $La_3Ga_5SiO_{14}$ gave the name to the big family of crystals, which have the unique piezoelectric properties in combination with luminescent, laser, and nonlinear optical properties. Recently, a strong interest was attracted to the langasite-type compounds containing magnetic ions [1]. Coexistence of electric and magnetic order parameters in these materials provide a new type of multiferroics.

In this work the high-pressure properties of a new multiferroic of the langasite family $Ba_3TaFe_3Si_2O_{14}$ up to 60 GPa were investigated in diamond-anvil cells (DAC) by synchrotron X-ray diffraction (XRD). A preliminary X-ray analysis of the initial sample revealed that value of cell parameters is $a$ = 8.538(2) Å and $c$ = 5.237(2) Å. Two structural phase transitions at $P \approx 5.5$ and 20 GPa were observed [2].

For the Mössbauer studies, iron in the samples was enriched in the $^{57}Fe$ isotope up to 50%. Synchrotron Mossbauer source (SMS) technique were used in the temperature range of 4.2–295 K. Strong enhancement of the Néel temperature $T_N$ was observed at pressures above 20 GPa and associated with the structural transformation. The highest value of $T_N$ is about 130 K which is almost five times larger than the value at ambient pressure (about 27 K) [3]. Raman spectroscopy data also reveal anomalies in phonon and electronic properties of these compounds at about 5 and 20 GPa.

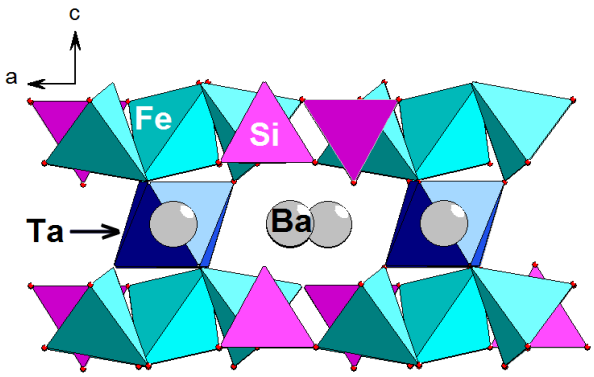


*Figure 1*. The unit cell of the iron langasite (sp. gr. *P*321, *Z*=1). All $Fe^{3+}$ ions are in the tetrahedral oxygen sites

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