

Raman spectroscopic characterization of synthesized mafic glass for Mars Moons eXplorer (MMX) Mission

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The Martian moons Phobos and Deimos would provide insights into the early evolution of Mars and the terrestrial planets [1][2]. The origin of these moons is still controversial, with the most likely scenarios being: 1) the capture of asteroids [3] or 2) by a large impact [4]. The main scientific goal of JAXA's Mars Moons eXploration (MMX) mission is to determine the origin of Martian moons. MMX mission includes in-situ observations by the MMX rover. The Raman spectrometer for MMX (RAX) onboarded on the rover would provide information of the mineral composition of surface materials on Phobos [5]. In the impact origin scenario, the building materials of Martian moons are considered to experience high temperatures around 2000 K and then cool [4]. This process would have formed quenched glass from mixtures of an impactor and Martian crust/mantle. Previous studies showed that Raman spectroscopy is useful to constrain chemical compositions of silicic volcanic glass [6][7]; however, no previous work was performed to characterize mafic quenched glass that would have been formed by a large impact onto Mars.

In this study, we perform Raman spectroscopy for synthesized glass particles. The synthesized glass particles were formed from powder mixtures of difference major element compositions, covering the possible range of mixtures of Martian mantle and asteroids. To synthesize a glass particle, a pellet of powder mixtures was heated to 1600–2300°C with aerodynamic levitation and CO₂ laser. Raman spectra of the synthesized glass particles were collected using a micro Raman spectrometer. In this presentation, we discuss the spectral characteristics (peak positions and their ratios) of synthesized glass particles for different chemical compositions and implications for detection of impact-induced quenched glass by RAX of the MMX mission.

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