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ALMA observations of Titanium and Aluminium bearing species in Mira

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Asymptotic giant branch (AGB) stars stand out as prominent contributors to the production of dust within our Galaxy. However, the intricate process of inorganic dust grain condensation in the outflows of AGB stars remains uncertain. Theoretical investigations, rooted in chemical and thermal equilibrium, have pinpointed aluminium oxides, titanium oxides, and silicon oxides as the primary contenders for serving as the nuclei around which dust particles coalesce in M-type AGB stars. Nevertheless, the mechanisms responsible for the remarkably efficient coagulation of molecules into dust grains remain poorly understood. In this study, our objective is to probe the formation of dust surrounding the nearby M-type AGB star, Mira, using finely resolved observations from the Atacama Large Millimeter/submillimeter Array (ALMA) across Bands 6, 7, and 8. Our analysis has successfully identified multiple spectral lines, including 46TiO, 48TiO, 49TiO, 50TiO, 46TiO2, 47TiO2, 48TiO2, 49TiO2, 50TiO2, AlO, AlCl, AlF, SO2, SO, SO2, SiO, and SiS. We have estimated the column density and abundance of the majority of these detected species. We aim to provide a more precise characterization of the aluminum and titanium budgets within the inner outflow region of Mira, with the ultimate goal of shedding light on the intricate processes governing dust formation in Mira's inner outflow.

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