Dust Seeding Molecules in a Massive Protostar -- Detection of TiO in Orion Source I

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We report the first detection of TiO in star-forming regions based on Atacama Large Millimeter/submillimeter Array observations of Orion Source I, a well-characterized massive protostar. Multiple rotational transitions are identified, with emission spatially resolved within ∼50 au, showing a compact distribution with a velocity structure consistent with the base of a rotating outflow. The spatial and velocity distributions of TiO are consistent with those of AlO, with both species being key dust seeding refractory molecules. The column density of TiO is derived to be 1.7 +- 0.2*10^{15} cm^{-2}, corresponding to $X_{TiO/SiO}$ ∼7.2 +- 0.9 *10^{-3}, comparable to CI chondrites and indicative of efficient dust-to-gas conversion near the protostar. We also identify a tentative detection of AlOH, which exhibits a more extended distribution along the disk surface, possibly indicating different conditions from those traced by TiO and AlO. The detection of TiO, a key dust seeding species, offers important constraints on refractory chemistry and the formation environments of primitive minerals, linking astrochemical processes in protostellar systems to the earliest stages of Solar System material formation.