SIO OUTFLOWS AS TRACERS OF MASSIVE STAR FORMATION IN INFRARED DARK CLOUDS

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We present ALMA Cycle 2 observations of SiO(5-4) outflows towards 30 Infrared Dark Cloud (IRDC) clumps, which are spatially resolved down to ~ 0.05pc. Out of the 30 clumps observed, we have detected SiO emission in 20 clumps. We discuss the association of SiO with mm continuum and FIR emission, and fit the SEDs of potential protostellar sources with radiative transfer models based on the Turbulent Core Model. In 6 of the 20 clumps the SiO emission is stronger than the 10 sigma noise level and appears to trace outflows being driven by protostellar sources that are also revealed as nearby mm continuum peaks. We locate the dense protostellar cores associated with the outflows in position-velocity space utilizing dense gas tracers DCN(3-2), DCO$^+$(3-2) and C^{18}O(2-1). The different morphology and kinematics of the outflows indicate different core structures, accretion histories and ambient cloud environments. The mass and energetics of the outflows indicate that these 6 protostars are in a relatively early evolutionary stage and some may eventually become massive stars.