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A Drastic Chemical Change in Protostellar-Disk Formation: IRAS 04368+2557 in L1527

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Sub-arcsecond images of the c-C_3H_2 and SO emissions have been obtained in the 0.8 and 1.1 mm bands toward the low-mass protostar IRAS 04368+2557 in L1527 as one of the early science projects of the Atacama Large Millimeter/Submillimeter Array. Along an edge-on flattened protostellar core, the c-C_3H_2 emission shows a double-peaked distribution. The two intensity peaks are located symmetrically on both sides of the protostar with a distance of 100 AU, while the emission is weak toward the protostar. In contrast, the SO emission is distributed around the protostar within the radius of 100 AU. On the basis of the velocity field of c-C_3H_2, the radius of the centrifugal barrier is evaluated to be 100 ± 20 AU. c-C_3H_2 mainly resides in an infalling rotating envelope, and is deficient inward of the centrifugal barrier. On the other hand, the velocity field indicates that SO is mainly distributed around the centrifugal barrier, and partly in the inner disk. This result demonstrates a drastic chemical change in the transition region between the infalling rotating envelope and the inner disk for the first time. We propose that an accretion shock around the centrifugal barrier is responsible for the drastic chemical change. Thus, interstellar matter will have to experience shocks before going into the disk. This result will provide new stringent constraints on chemical evolution toward the disk.