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Characteristics of flow around a sphere with a surface trip. JIN CHOI, KWANG MIN SON, WOO-PYUNG JEON, HAECHEON CHOI, Seoul National University — The drag on a sphere in a freestream is significantly changed by a surface trip wire. Although this behavior is well known, the flow characteristics have not been clearly presented except that the surface trip wire promotes transition to turbulence. In our study, we vary the diameter and location of the trip wire, measure the drag, surface pressure and velocity profiles inside the boundary layer at $Re = 0.5\times10^5 \sim 3\times10^5$, and conduct flow visualization. With a thick trip wire ($k/d = 1.3\times10^{-2}$), a separation bubble is formed right after the trip wire and transition to turbulence occurs there, resulting in main separation delay and drag reduction. On the other hand, with a thin trip wire ($k/d = 0.3\times10^{-2}$), transition to turbulence does not occur at the trip wire but a separation bubble is newly formed at $100^\circ \sim 115^\circ$, which significantly delays the main separation. At high Reynolds number, this separation bubble disappears and transition to turbulence occurs at the trip wire. When the trip wire is located downstream, transition to turbulence and drag crisis occur at lower Reynolds number.

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