The Effects of Two Gas Flow Streams with Initial Temperature and Pressure Differences in Cold Spraying Nozzle

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Abstract：In order to inject powder into the nozzle in cold spraying, the pressure of the powder carrier gas at the nozzle inlet must be equal to or higher than the pressure of the propulsion gas, and the temperature of the powder carrier gas needs to be lower than the temperature of the propulsion gas to prevent from buildup or clogging by particles in the nozzle. The gas flow behavior resulting from the lower temperature and the higher pressure of powder carrier gas has an important effect on the particle acceleration in the nozzle. Several issues related to the gas flow will be examined through numerical simulation, including the initial pressure differential, the nozzle throat diameter, and the prechamber length between the injection tube outlet and the nozzle inlet. For different initial pressure differentials, nozzle throat diameters and prechamber lengths, the mixing conditions of the two gas flow streams in the nozzle are quite different and the negative effect of the inadequate mixing of the two gas flow streams in the nozzle on the particle acceleration is obvious. It is found that using lower differential pressure, larger nozzle throat diameter and longer prechamber for a certain diameter of powder injection tube can enhance the particle acceleration in the nozzle.

Key words: Cold spraying; Powder carrier gas; Initial pressure differential; Prechamber