Plasma Reactor

in plasma chemistry and metallurgy, a unit of an assembly in which heat- and mass-transfer processes are carried out with the participation of a low-temperature plasma. The term “plasma reactor” is sometimes applied not only to an individual unit but to a plasma assembly as a whole. The basic requirements of plasma reactors are (1) attainment of an adequate mixing of the reagents, (2) provision of an adequate extent of the zone of interaction, and (3) provision of conditions for efficient heat transfer and mass transfer with minimum heat losses.

When high-frequency induction plasmatrons are used to generate the plasma, the reaction zone can be combined with the discharge volume; such a reactor is called an open-type reactor. Jet plasma reactors, in which the plasma is produced as a shaped jet, exist in two types—direct-flow and counter-jet (Figure 1). An increased time of contact between reacting materials and intensified heat transfer and mass transfer—by comparison with simple direct-flow plasma reactors—are achieved in plasma reactors operating in the counter-jet mode, in open-type plasma reactors, and in cyclone-type plasma reactors; such improved results can also be attained by the imposition of a constant electric or magnetic field, or both, on the high-frequency volume discharge.

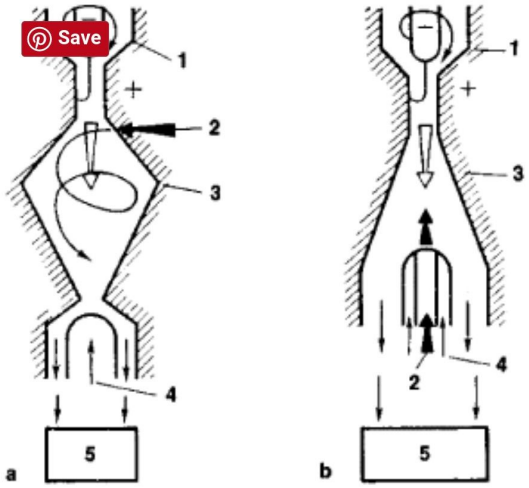

Figure 1. Schematics of plasma chemistry assemblies with jet reactors: (a) direct-flow type, (b) counter-jet type; (1) plasmatron, (2) raw-material feed, (3) plasma reactor, (4) quenching agent, (5) product receiving and processing unit

Multiple-arc plasma reactors are promising with respect to the achievement of a uniform

temperature field of the plasma flow, increase of the flow's power, improvement of mixing of reagents, and intensification of heat transfer and mass transfer.