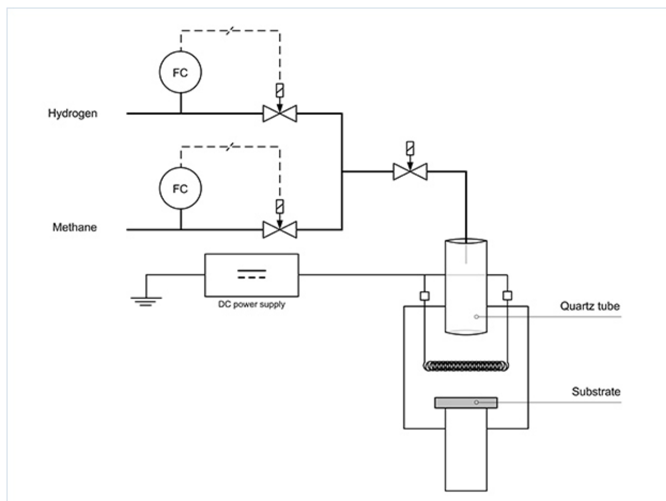
Diamond has got a unique wear resistance, therefore diamond coatings are often used to improve the performance of cutting tools and wear parts. In order to obtain diamond coatings over adequate substrates, it is necessary to combine the suitable amounts of the right gas precursors and heat them for reactions to occur.

For attaining thin-film coatings compliant with the highest quality standards the process gas system must be capable of providing superior layer uniformities. Easy maintenance is also a major concern when large area coaters are involved. Bronkhorst fully understands the Glass Coating Industry's demands and has therefore developed sophisticated solutions specially addressed to meet the demands of state of the art large area glass coating applications

Process Solution

One of the most versatile methods for the production of diamond films is the hot-filament vapour deposition technique (HFCVD) where the gas mixture is heated by being passed along thin W or Ta wires (100 to 300 μm) that are heated up to 2400ºC. Usually only two gases are needed: H_2 and CH_4, the methane being diluted at 1 to 2 vol% in the hydrogen. The total pressure inside these cold-wall HFCVD reactors can vary typically between 20 mbar and 200 mbar, the total flow depending on the size and geometry of the reactor chamber. A recent type of diamond coatings is termed nanocrystalline diamond (NCD), in opposition to the microcrystalline diamond films (MCD). NCD is characterized by a nanometric crystallite size (1 nm to 50 nm) and an extremely smooth surface that retains most of the hardness of MCD and has got improved wear and friction behaviour relatively to MCD. These coatings generally need the addition of a third, inert gas, that contributes to the formation of NCD by enhancing re-nucleation processes during growth an by changing the thermal load of the gases inside the chamber, also affecting the substrate heating. This system is more complex than the MCD one and further care is needed in the control and monitoring of the feed gases



LA further modification of such reactors consists in doping the diamond coatings with Boron (MCD and NCD) during growth in order to make them electrically conductive. For this liquid precursor containing Boron (B) species is generally used and a gas is bubbled through it, carrying the Boron containing vapour to the hot filaments and to the diamond coatings. The doping level is adjusted by selecting the right concentration of Boron in the precursor and by adjusting the gas flow through the precursor. The task becomes increasingly difficult when doing NCD since three gases are already at play. The role of the thermal mass flow controllers (such as EL-FLOW Select, LOW-dP-FLOW or IN-FLOW series) is insurmountable in this application or any other involving CVD processes for diamond growth from gas phases.

Recommended Products

EL -FLOW SELECT
F-201CV

LOW-FLOW
F-202EV

IN-FLOW
F-201CI