MEC

THERMAL SPRAY FACILITIES

COATING SYSTEMS FOR HVOF, PLASMA, FLAME SPRAY, ARC SPRAY & ROD SPRAY

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HVOF COATING ON PISTON RING

A NEW AND IMPROVED PROCESS HAS BEEN DEVELOPED RECENTLY OVER CONVENTIONAL CHROME PLATING AND MOLYBDENUM COATING. IT ISHVOFCOATING.

Strict environmental emission laws have forced major changes in the design of power cylinder components like the internal combustion engines rings. Lubricating oil consumed during engine operation contributes to one third of the particulates emitted. Therefore it becomes essential to reduce the oil exposure to combustion gases by raising the top compression ring closer to thetopofthepiston.Raisingthecompressionpiston ring position will force the ring to operate under increasingly unfavorable conditions of higher combustion forces, elevated temperatures and thinner lubricating films. Because of which the coating on the piston ring is affected. Hence a suitable coating is desired which could resist these tough environmentalconditions.

The majority of top compression rings produced today are plated with chromium. Chromium plating has proven to have poor wear and scuff-resistant properties at higher ring temperature and boundary lubrication conditions (Fig. 2 shows a scuffed liner). Thermally sprayed molybdenum coatings have been used as substitutes for chromiumplatingformorethantwodecades.

Fig. 1 : Piston Ring and Piston Assembly

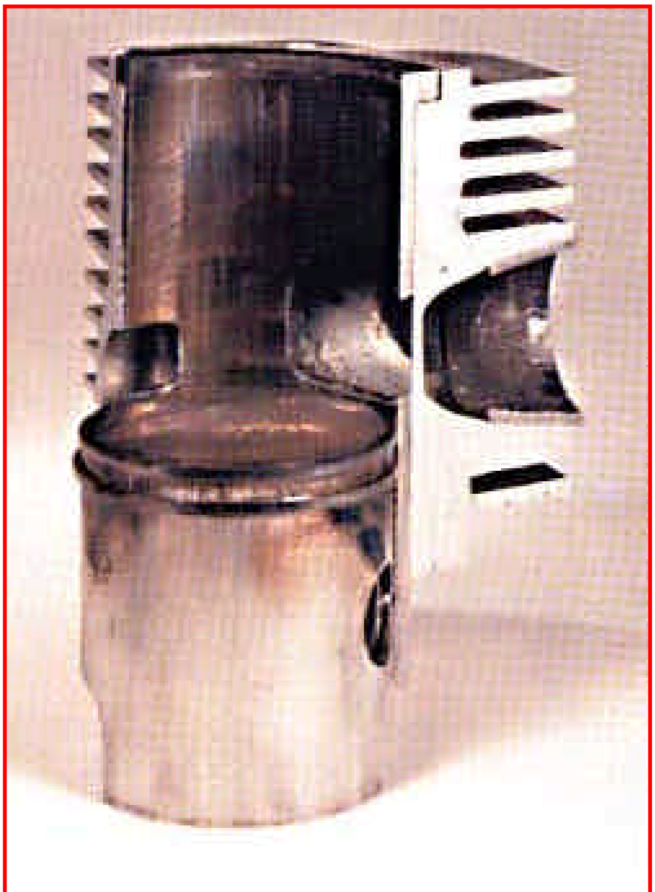

Fig. 2 : Piston Liner damaged because of scuffing problem

However, for today's high performance engines chromium plating and molybdenum spray coatings are the limiting factor in engine endurance. For sealing purposes it is desirable to have highly wear-resistant ring face coatings. The ringgapareaincreasesasthetopcompressionring face coatings wear, thereby allowing blow-by of combustion gasestothesump.

Liner wear also causes a ring gap area increase; therefore it is essential to minimize induced wear caused by the ring face. Consequently, compatible ring and liner materials allowing for lowersystemwear and component longevityhave becomeessential.

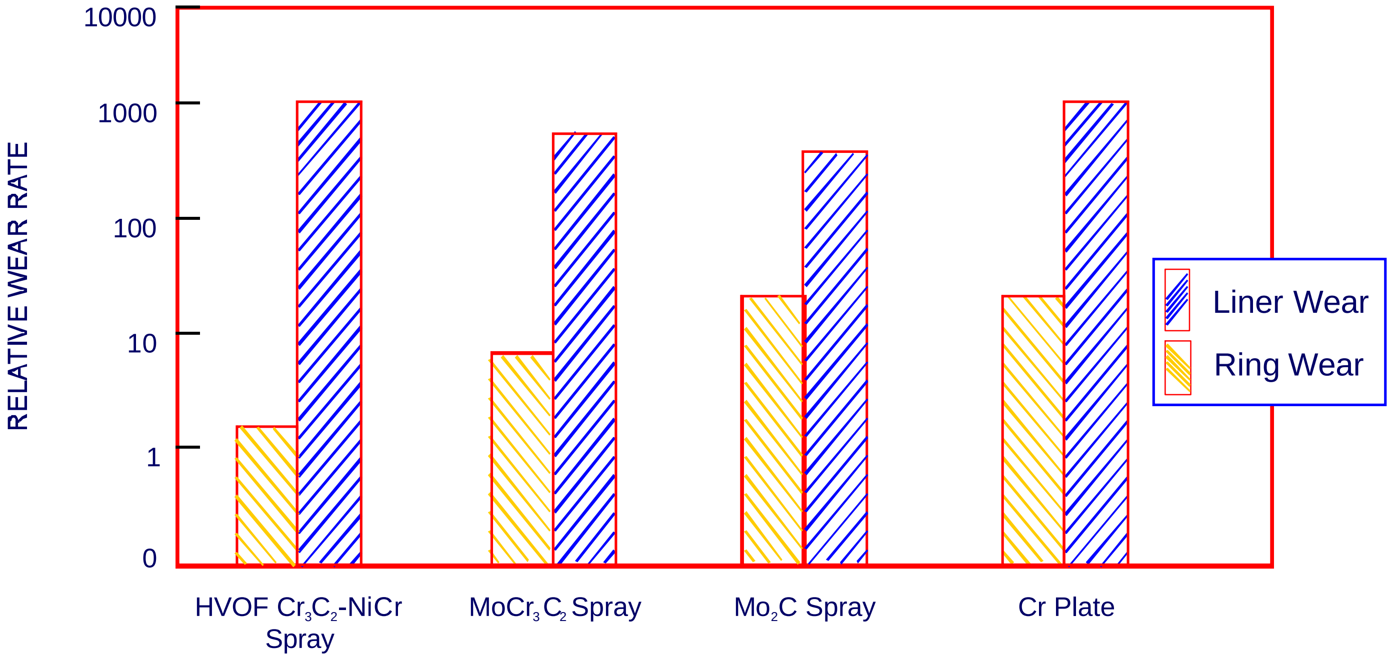

Fig. 3 : Summary of the piston ring coating and cylinder liner wear results under steady state condition engine tests comparing thermally sprayed coatings and electroplated chromium

When various coatings were subjected to trials for improved quality, with respect to its wear properties HVOF sprayed Cr_3C_2-NiCr coating has given excellent results. (Ref Fig 3).

HVOF THERMAL SPRAYING

This process uses an internal combustion (rocket) jet to generate supersonic gas velocities of approximately 1800 m/s, generally in the range of Mach 4-5. Combustion fuels are mixed with oxygen in the gun. This includes propylene, acetylene, propane, hydrogen, and kerosene. When burned with pure oxygen, these fuels produce gas temperatures greater than 2700°C. Fig 4 describes the working principle of HVOF. When the coating particles are introduced in the flame, they pick up sufficient high energy of the flame before striking the surface to be coated. Because of which the resultant coating is not only hard and dense but gives requisite properties as desired to operate a piston ring.

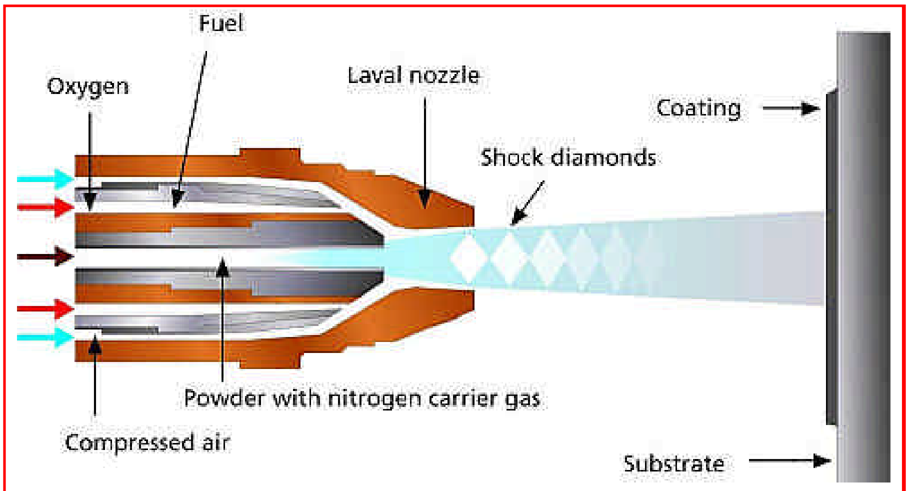

Fig. 4 : Principle of HVOF Coating

MEC offers together with its experience of 40 yrs in thermal spray coatings a state of art coating technology to effectively deposit such coatings using Gas or Liquid Fuel HVOF system. These coatings are not only easy to apply, environmental friendly but also offers superior coating properties which are very important to enhance the life of PistonRing.

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