Wafer thin

Truck, bus, coach and van makers, driven by emissions legislation, should also think outside the drivetrain when it comes to the latest micro-fine coatings. Ian Norwell looks at what they offer

Above: Tribobond 41 on piston pin before running in Rz 0.5µm (left) and after running in Rz 0.1µm (right)

Away from the drive line, where low-friction coatings are already being adopted, there are benefits to be gained from improving surfaces in mechanisms such as door locks, seat adjusters and switches. Interior cabin structures can also benefit, while functional coatings on exposed components can eliminate the need for maintenance. And be it a truck, van or bus, the impression of quality that comes from paying attention to items that are touched or operated can make a real difference.

Using the right coatings can also save the expense of chrome and even produce a better result. And, unlike many conventional surface finishes, technologies, such as physical vapour deposition (PVD), generate no toxic waste.

Meanwhile, low friction coatings, such as amorphous carbon layers, can offer new advantages. When moving parts are subjected to large frictional forces, for example, such coatings not only extend component life by massively increasing wear resistance, but they also improve performance.

Additionally, these coatings tend to have a polishing effect on counter surfaces, thereby reducing their roughness and related contact pressures. Also, the ultra-thin coating thickness of 1 to 4µm is typically within gear wheel tolerance, and the option of low-temperature processing allows tempered low-alloy steels to be coated, without loss of hardness. What's more, looking back up the manufacturing cycle, it's not just the finished product that can gain from low-friction coatings. Think about moulding dies and the tooling for production: coatings can enhance the product and save energy.

Demanding common rail

Returning to the driveline, as well as coatings for highly loaded and stressed engine and transmission parts, components upstream of ignition are as important as those behind the firing line. With common rail injection pressures of well over 2,000 bar at Euro 6, and some systems allowing a further boost between rail and injectors, component survival and efficiency are challenges.

"At these pressures, fuel becomes very abrasive and the need for protection is higher than ever," comments André Hieke, global segment manager for automotive components at Swiss coating specialist Ionbond. "That's where our amorphous DLC [diamond light carbon] coatings work hardest for their living."

Increases in service life are naturally also expected by all of the vehicle makers. "We work with the major OEMs because, with service intervals on their truck diesels now up to 150,000km, it is even more important to refine engineering tolerances," comments Hieke. "These coatings are a key ingredient." And he lists not only pistons, rings, liners, gudgeon pins, tappets and cylinder bores as clear candidates for treatment, but all surfaces that impact, roll or slide as needing specific coatings to optimise performance.

"Hard and wear-resistant coatings applied on components in the valve train, for example, can reduce frictional losses in lubricated operation by up to 40%," explains Hieke. And while pumps and injectors may have the advantage of being cooled by fuel, their coatings also need to be designed for the task.

"Common rail systems have tightened the ratchet even more when it comes to highly loaded components," confirms Hieke. While they may have brought big increases in torque and improvements in fuel efficiency – a win-win for fleet engineers – coating specialists have had to develop products that will preserve, and even extend, component life under very arduous conditions.

As engine manufacturers move forward in design, with such developments as assembled composite camshafts to save weight, tolerances tighten even more and, in so doing, lead to further challenges for the coating companies. "We haven't invented the perpetual motion machine yet, but the search for it goes on," quips Hieke.