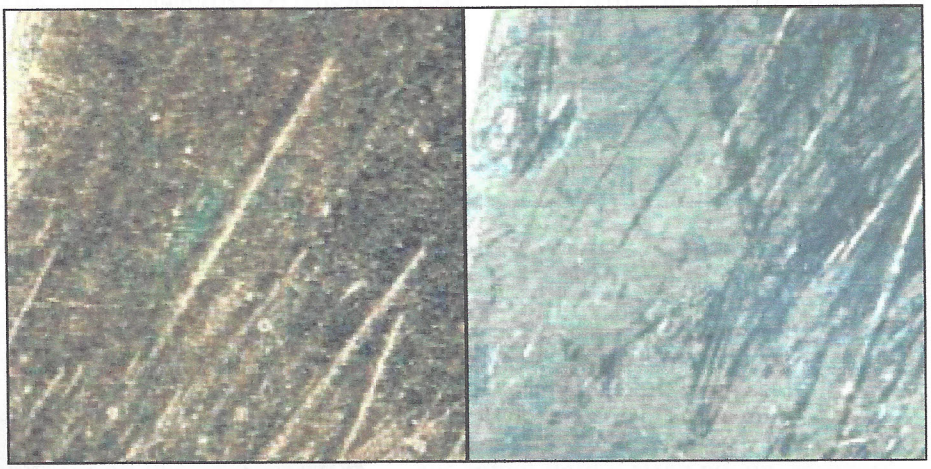
Coating helps P/M tooling beat the heat

A European manufacturer of powder-metal (P/M) components could only produce a few parts before friction heated the compaction tooling enough that it would bind. The heat generated during powder compaction also made part ejection difficult. Interestingly, the firm's U.S. counterpart didn't experience these same production problems though the materials and equipment settings were identical.

Swapping European for U.S. tooling helped resolve the issue: The U.S. version had a coating on load-bearing surfaces of both upper and lower punches as well as the tool's core. The treatment is called Metalife/polymer (MLP).



The highly magnified digital images of a polished tool surface before and after MLP treatment show CPM 3V tool steel polished to a finish of 8 RMS. The light colored regions in the photo at right are the chrome bonded to the surface. The blue-green flecks are the MLP polymer imbedded in the pores of the chrome. Note the irregular surface conditions of the noncoated tool at left. Also compare the noticeable improvement in surface regularity with the MLP-coated steel.

MLP coating from Metalife Industries Inc., Reno, Pa., (*www.metalifeind.com*) is based on molecular-bonded thin-dense chrome. It consists of a petrochemical wax combined with a polishing agent and other ingredients that promote polymer impregnation into the chrome. After thoroughly cleaning tool surfaces, the coating goes on as the tool sees a high-amperage charge. The charge helps promote good bond strength between the 0.0001-in.-thick, 72 R_c coating and tool surface.

The tool is heated to 195°F and the chrome-plated surfaces are treated with the proprietary MLP compound. Under heat, the highly cross-linked, long-chain polymer flows into the porous microcrystalline structure of the chromium. Polishing helps bury the polymer deep into the pores creating a smooth, hard, and lubricious surface with a low coefficient of friction.

The coated tools easily ran at 8 cycles/min during initial testing at the European plant. And at 12 cycles/min ejected part temperatures were 165°F, well within acceptable limits. Speeding cycle times to 15/min resulted in ejected part temperatures of 185°F. This is said to be a great improvement considering the uncoated tools wouldn't run long enough at even 8 cycles/min to accurately gauge part temperatures.

Reducing friction and temperature also improves the performance of close-tolerance tools. Clarion Sintered Metals Inc., Ridgway, Pa., for example, produces shock-absorber components on a dedicated automated line. After production of only 7,000 to 9,000 parts, however, abrasive wear of the uncoated tool resulted in rejected parts.

The tool with MLP coating now produces an average of 45,000 units. Clarion reports that the average tool life was further extended to 250,000 parts/tool when surface finishes on critical areas of the tool before coating were improved. Clarion claims one tool was able to produce 395,000 parts.

Likewise, tools producing a large automotive transmission gear at Metaldyne Sintered Components, Ridgway, Pa., often failed from the heat generated by extremely high-compaction forces. Part temperature taken at time of ejection averaged 185°F. In contrast, temperatures averaged 115°F on parts made with tooling where all load-bearing surfaces were MLP coated.

Other MLP tool-coating applications are employed in metal-stamping tools as well as forming dies and mandrels. MLP coating on plastic-injection mold cavities and cores not only improves wear resistance but also helps bolster mold release. **Circle 630**

MLP tool coating properties

PROPERTY	CHROME	CHROME AND POLYMER
Hardness	R_c 72	R_c 72
Thickness (average)	0.00005 in./0.0001 in.	0.0001 in./0.0002 in.
Maximum temp. (process)	140°F	195°F
Maximum temp. (operating)	–400 to 2,300°F	–400 to 600°F
Coefficient of friction	Approx. half the base metal	< half base metal
Purity of chrome	99.4%	99.4%
Ductility	Half the thickness of metal base in standard bend test	Thickness of metal base in bend test