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Y-1547

Engineering and Equipment

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MASTER

A SPECIAL MACHINE TOOL SLIDE
BEARING MATERIAL (U)

Charles Asmanes

UNION CARBIDE CORPORATION
NUCLEAR DIVISION
OAK RIDGE Y-12 PLANT

operated for the ATOMIC ENERGY COMMISSION under U. S. GOVERNMENT Contract W-7405 eng 26

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ABSTRACT

Many machine tools at the Oak Ridge Y-12 Plant have been equipped with Teflon wear pads under the slides. The material has minimized the amount of maintenance work and eliminated troublesome lubrication problems. Teflon is easily applied to machine ways, usually by clamping the material under the wiper pads.

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INTRODUCTION

During the past three years, several machine tools within the Y-12 Plant have been equipped with Teflon wear pads under the slides.

The use of Teflon for slide bearing material was motivated by the need to solve some immediate maintenance and design problems, namely:

1. Return old machines with badly worn or galled slideway surfaces to service quickly and economically, and avoid the relatively high cost of repair by slide-rail scraping or replacement. Thus, economy became the keyword.
2. Reduce and stabilize stickslip in slide motion at some predictable level on numerically controlled or tracer-controlled machines, where a predictable velocity error is essential to the accuracy of the controlled motion and where the design of slideways and lubrication systems fail to accomplish this requirement.
3. Reduce galling and selective wear on slideways where the service is severe, as in machining graphite or tungsten.

SUMMARY

The application of polytetrafluoroethylene (Teflon) to machine slideways has minimized the amount of required maintenance work and eliminated troublesome lubrication problems. In addition, slide frictional characteristics remain virtually constant and, therefore, the difficulty in achieving slide breakaway after extended periods of disuse has been reduced considerably.

Teflon is easily applied to machine ways, usually by clamping the material under the wiper pads.

DISCUSSION OF THE WORK

MATERIAL

Teflon^(a) is the trade name for the plastic, polytetrafluoroethylene. This material has a coefficient of friction against steel of 0.04 to 0.25 when the surfaces are dry and a load of about five pounds per square inch is applied. If the surfaces are lubricated, the value decreases to about 0.02. These values are about the same for both the static and dynamic coefficients of friction; thus, most of the stickslip which occurs on conventional lubricated slides is eliminated.

The yield point of this material at 73° F is 600 psi.

In most applications, the surface loading on the plastic is approximately 5 - 10 psi. Where heavy loading is expected, the film of plastic should be kept thin (5 - 10 mils) so that the deflection and cold flow are kept to a minimum.

Rulon^(b) is a modified polytetrafluoroethylene that possesses about the same coefficient of friction but exhibits a higher compressive strength and better wearing properties.

INSTALLATION

Both Teflon and Rulon are easily applied to machine ways. The extent of machine-tool slide preparation prior to installing the plastic material will depend on the required accuracy expected from the machine.

When a high degree of accuracy is required (as on numerical or tracer-controlled machines), some scraping and fitting may be necessary. On the other hand, some conventional machine tools with less stringent accuracy requirements need only limited slide stoning prior to the Teflon installation. It should be emphasized that any scraping required is not done to acquire a bearing fit, but is done primarily for slide-alignment purposes.

The method used in attaching the Teflon to the machine slide depends upon the design of the machine. In most cases attachment can be made mechanically by clamping the material under the wiper pads. Other applications may require cementing the plastic to the slide. In these cases the Teflon is treated on the surface which is cemented prior to installation. Figure 1 presents a schematic drawing to show how

(a) Trade name of E. I. duPont de Nemours and Company.

(b) Trade name of Rulph V. Rulon, Inc.

the Teflon is installed on flat or V slides. Figure 2 shows the material on a flat slide and also the wiper pad just before it is clamped in place.

Figure 1. MANNER IN WHICH TEFLON IS INSTALLED ON FLAT OR V SLIDES PRIOR TO INSTALLING THE WIPER PAD COVERS.
(Teflon may be Attached by Cementing or Mechanical Holding).

Table 1 lists the types of machines at Y-12 that have had this special installation and the principal reasons for the installation.

EXPERIENCE

Machine-tool operation on which Teflon wear pads have been installed has been uniformly good. Only a minimum amount of slideway maintenance has been required due, mainly, to the elimination of troublesome lubrication problems. The slide frictional characteristics now remain virtually constant and, as a result, the difficulty in achieving slide breakaway after extended periods of disuse has been reduced by a factor of approximately five.

Because slide friction has been reduced, the gib settings can be tighter, resulting in an increase in the accuracy of the slide motion.

On Teflon installations which have been inspected after extended use, there has been virtually no wear.

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Figure 2. TEFLON APPLIED TO A FLAT SLIDE. (Wiper Pad Ready for Clamping)

Table 1
MACHINE TOOLS HAVING TEFLON OR RULON
ATTACHED TO SLIDES

Machine ⁽¹⁾	Reason for Installation
18" Standard Lathe 12" Standard Lathe	Economic repair of slide surfaces that were severely worn.
30" Turret Lathe 95" Surface Grinder	Economical repair of the galling condition on the slideways due to carbon dust.
Tape-Controlled Lathes	To eliminate lubrication problems and improve the dynamic performance of the machine by reducing starting friction and stabilizing running friction.
66" Vertical Turret Lathe Used as an Inspection Machine	Reduce starting friction and increase slideway accuracy.
25" Standard Lathe	Reduce starting friction and increase slideway accuracy.
Horizontal Mill	Reduce starting friction and correct alignment of the spindle.

(1) None of these machines has had bearing problems where Teflon or Rulon has been applied. All machines are still operating satisfactorily.

POTENTIAL APPLICATIONS

The major advantage of installing tetrafluoroethylene resin (Teflon) on machine tool slides is that it upgrades the machine. In addition, the potential for cost savings through the reduction of time-consuming scraping operations is outstanding since it is possible to return a conventional machine tool quickly to service.

The use of Teflon should be considered for most applications where dry bearings having low frictional characteristics are required. Teflon installation should also be considered on any application where chemical inertness or low moisture-absorption properties are required.