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Lapping and Polishing Characteristics of Soft Material Tool Use

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Lapping with a 6.6 nylon lap and a cast iron lap was applied to workpieces of nonelectrolytic nickel-plated film and aluminum alloy with SiC #2000 abrasives. Nonelectrolytic nickel-plated workpieces with nylon lap reached 0.1 μm Rmax in surface roughness and were covered with fine scratches from the main operation of held abrasives on the lap surface. However, when a cast iron lap was used, the surface roughness was 0.5 μm Rmax and rough irregular ups and downs appeared owing to the rolling behavior of abrasives. Nylon lap has a large lapping ratio for both workpieces of nonelectrolytic nickel-plated film and aluminum alloy, although it shows a smaller stock removal than hard cast iron lap. On the other hand, the lapping ratio of cast iron lap is large for aluminum alloy workpieces, but decreases drastically to 1/10 for nonelectrolytic nickel-plated workpieces. Silicon crystal, quartz glass and heat-treated maraging steel were lapped with MC nylon lap, hard polyurethane foam sheet, fluorocarbon foam sheet and cast iron lap, with Al_2O_3 #1000 abrasives. Each workpiece was finished to nearly mirrorlike surfaces with only these soft plastic laps. In particular, stock removal of silicon workpieces yielded a small value by the light action of held abrasives on lap surface in soft tool lapping, while cast iron lapping yielded a large value owing to cracking and cleavage. In polishing, the surface roughness of quartz glass workpieces, measured by the stylus method, was 0.8 nm Rmax with pitch polisher and 0.3–0.5 nm Rmax with soft fluorocarbon foam polisher, with exactly the same polishing conditions. Use of a soft tool in lapping and polishing seems to contribute to the improvement of the work surface quality and realization of ultraprecision machining.