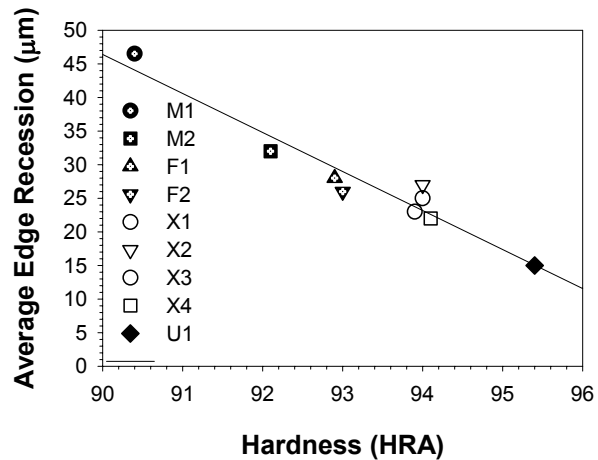


WOOD MACHINING & TOOLING RESEARCH

CARBIDE TOOLING RESEARCH

Tool wear mechanisms for carbide tooling used in machining particle board on CNC routers has been studied extensively under the WMTRP tool materials/tool wear research initiative. Cutting experiments conducted on tools having several different grades of cemented tungsten carbide have indicated that wear occurs predominately on the clearance face of the tool. This suggests that wear occurs mainly because of friction (rubbing) between the clearance face of the tool and the workpiece surface. The amount of wear was found to increase with increasing grain size and binder content. The amount of wear for a given cutting distance appears to be well correlated with the bulk hardness of the tool material (harder tool materials outperform softer tool materials). Examination of the worn edges under a scanning electron microscope indicate that the cutting edge is worn by preferential removal of the metal binder from the between the tungsten carbide grains. This removal of binder weakens the bond between the tungsten carbide grains leading to the mechanical removal of the grains from the cutting edge. Based on this research, it appears that the dominant wear mechanism for cemented tungsten carbide tools used in machining particleboard in CNC router applications involves abrasive wear; with wear rates depending directly on the bulk hardness of the carbide (which increases with reduced grain size and reduced binder content).

Carbide Grade	Composition (wt. %)		WC Avg. Grain Size (μm)	Hardness HRA
	WC	Binder		
M1	90.5	9.5	1.7	90.4
M2	94.0	6.0	1.7	92.1
F1	96.0	4.0	1.3	92.9
F2	96.5	3.5	1.2	93.0
X1	97.0	3.0	0.7	93.9
X2	95.0	5.0	0.8	94.0
X3	97.0	3.0	0.7	94.0
X4	97.0	3.0	0.8	94.1
U1	97.5	2.5	0.4	95.4



The Wood Machining & Tooling Research Program (WMTRP) is a multidisciplinary program involving the fields of Mechanical Engineering, Industrial Engineering, Manufacturing Engineering, Material Science, and Wood Science. The program mission is to provide the woodworking industry with personnel educated in machining and tooling technology and provide applied research results aimed at improving efficiency and wood utilization. Major program support is provided by the U.S. Department of Agriculture.

For more information on WMTRP research activities please contact Mr. Richard Lemaster, WMTRP, Box 8005, NC State University, Raleigh, NC 27695. Phone: 919 515-1548, Fax: 919 513-3496 E-mail: richard_lemaster@ncsu.edu. WMTRP web site: www2.ncsu.edu/wmtrp