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Feeling Like a Grad Student Again

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Retirement makes University of Dayton researcher Howard Knachel feel like he's in his 20s again, except Knachel isn't exactly retired all the way.

Knachel, a chemistry professor emeritus, doesn't have an on-again, off-again retirement like Minnesota Vikings quarterback Brett Favre. Knachel retired in May 2007, after 34 years at the University. He returned to the lab a few months later and has been there ever since searching for better ways to clean commercial metal equipment like metal stampers or clean metal for painting

without causing corrosion.

"It's like doing research in graduate school," Knachel said. "You have a problem to solve. It's fun from that point of view.

"I planned in retirement to finish projects I had begun with undergraduate students. Then there was a need for someone who could do nuclear magnetic resonance spectroscopy on compounds containing the element fluorine (to determine their structure). I'm still interested in and enjoying the experiments."

Knachel and colleagues at the University of Dayton Research Institute investigated whether metals cleaned by a solution of rubbing alcohol and fluorocarbons were being corroded and what was happening within the mixture as it aged to cause corrosion.

Fluorocarbons, which are compounds produced by substituting fluorine for hydrogen in a hydrocarbon, are used as a lubricant, refrigerant or fire extinguishing agent. The fluorocarbon-alcohol solution replaced Freon and trichloroethylene when they were banned for their polluting properties. Rubbing alcohol has very good cleaning properties, but it is a fire hazard in closed spaces, Knachel said. Rubbing alcohol mixed with fluorocarbons is a good cleaning agent that doesn't burn. However, this solution produces very small quantities of fluoride ion, which corrodes metals.

"We found conditions (such as lower temperatures) where there was no evidence of corrosion of metal surfaces," Knachel said. "Our studies have resulted in recommendations regarding shelf-life, storage temperature and handling of the fluorocarbon-alcohol cleaning solution."

Knachel, along with researchers from the University of Dayton Research Institute, will present their findings at the national American Chemical Society meeting March 21-25 in San Francisco.

In addition to large commercial metal equipment, the fluorocarbon-alcohol solution is often used to clean microelectronics.

Finding the minimum amount of alcohol in the fluorocarbon-alcohol solution, without compromising its cleaning properties, is the ultimate goal, Knachel said. Less alcohol further slows the corrosion process.

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