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Funding Source: College of Engineering Undergraduate Research Option

### **Electric arc production of nanoparticles for energetic materials**

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Thermite is a class of energetic material (similar to explosives) which consists of a fuel and oxidizer which react chemically to release energy. These materials are of interest because they can contain over 2.5 times more energy than TNT and they can be made from relatively benign components. The rate at which these materials react depends on the size of the fuel and oxidizer particles. Traditionally prepared thermite has relatively large particle sizes and therefore tend to react slowly. We are producing a new type of thermite called super-thermite which uses very small particles known as nanoparticles. These small particles of fuel and oxidizer react much more quickly than traditionally prepared thermite. Using this method we can prepare super-thermites which burn at over 2,000 meters/second. These properties make super-thermite an ideal replacement for several toxic lead containing energetic materials. However, super-thermite materials are currently too expensive for most applications. We are researching several new methods of preparing nanoparticles for super-thermite which will reduce their cost. One method we are using is called plasma arc-discharge, and actually very similar to an arc welding process. In arc welding electricity is used to form plasma arc. The heat from the arc melts the metals and fuses them together. In our process we continue to heat the material until it evaporates and forms a vapor. When the vapor cools it condenses forming nanoparticles. This process has been used previously to prepare nanoparticles of aluminum, silicon, and copper oxide. In the near future we will extend this method to other materials as well. The benefit of this method is nanoparticles can be prepared from relatively affordable bulk materials. Using this method we hope reduce the cost of preparing super-thermite from over \$20.00/gram to less than \$0.25 per gram.