INTRODUCTION
The goal of this project is to produce surfaces with characteristics in the nanometer to micrometer range that enable desired functionality for complex-shaped components. Surface functionalization will be realized using a magnetic field to locally manipulate abrasives, which cause material removal and surface deformation. This magnetic finishing (MAF) process will be specifically applied to austenitic stainless steels and ultra high molecular weight polyethylene (UHMWPE) due to their immediate relevance to biomedical applications, including knee implants. This presentation focuses on producing a hybrid nanoparticle consisting of magnetic material and abrasives. One example of such a particle is a core shell nanoparticle.

SURFACE FUNCTIONALIZATION BY MAGNETIC ABRASIVE FINISHING

WETTABILITY
The wettability of a material is the tendency of a liquid to adhere to its surface. One way to gauge wettability is by measuring the contact angle between the given surface and a drop of liquid. When two different materials are placed in contact, a large difference in wettability between their respective surfaces has shown to increase the fluid film thickness between them and therefore improve lubrication. MAF will be used to texture the biomedical components’ surfaces in order to improve lubrication and decrease wear in the components.

MAGNETIC ABRASIVE FINISHING
MAF is a finishing process used to remove material from a surface using abrasives or a magnetic abrasive slurry that is manipulated via a magnetic field. The abrasives/slurry used in MAF must be:
1) Harder than the material being finished
2) Manipulated in a magnetic field (magnetic)
3) Small enough to produce the nano-scale material removal

Solution Precipitation is a process by which a precursor is injected into a solution under inert atmosphere at a given temperature. The resulting solution is then refluxed for a given amount of time until it precipitates.

Solvothermal is a process by which all reactants are placed in a sealed stainless steel reaction bomb shown to the right. It is then placed in a furnace at given temperatures for a set amount of time. The combined heat and pressure allow the chemical reaction to take place.

CONCLUSIONS
Both spherical (dots) and rod-like magnetic nanoparticles were successfully synthesized. The hybrid magnetic abrasive nanoparticle synthesis is still being optimized. Attempts are being made to decrease agglomeration and create a core-shell particle with iron oxide as the core and an abrasive as the shell. Polishing tests are being carried out to determine the current particle’s effectiveness as a magnetic abrasive.

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