

Enhanced Manufacturing Processes for Body Armor Materials

PROBLEM/OBJECTIVE

Five years ago, the body armor plates used by soldiers were extremely heavy, reducing the soldier's mobility and dramatically increasing their fatigue. This resulted in decreased fighting capability and increased casualties. With U.S. combat forces being increasingly exposed to small arms fire, new body armor was required.

Lightweight, state-of-the-art ceramics were the material of choice for the new body armor, but manufacturing costs were very high - up to \$850/plate. This project was a joint venture between the Army and Marine Corps to find an economical and lightweight replacement for the body armor currently used in the field. The ultimate result was a composite ceramic plate capable of stopping multiple assault rifle projectiles, at a cost of less than \$500/plate, and at a production rate significantly above the original planned capacity.

Now fielded, Small Arms Protective Insert (SAPI) plates are an integral part of the new Interceptor Body Armor (IBA) system used by the Army and Marine Corps. They have saved the lives of numerous Soldiers and Marines in Iraq and Afghanistan, providing increased protection while weighing 50% less than previously fielded body armor plates.



ACCOMPLISHMENTS / PAYOFF

Process Improvement: SAPI plates are manufactured from either boron carbide or silicon carbide. Both are currently in production.

Boron carbide ceramic is first extruded in a tube, then cut roughly to size. The plates are rolled to the correct thickness in a slab roller, then layered with graphite molds. Finally, a stack of 28 plates is placed in the furnace, which compresses the plates while heating them to finish the process.

Reaction bonded silicon carbide (si/sic) tiles are preformed with a high sic and low resin content. The ceramic is pre-fired at low temperatures and then reactively infiltrated with silicon.



Implementation and Technology Transfer: This project has been implemented on the multi-service Interceptor Body Armor. Together, the Army and Marine Corps have procured more than 500 thousand plates, and are fielding them to troops stationed around the world.

Expected Benefits: Through this ManTech effort, the cost of the SAPI has been decreased from \$850 per plate to \$525 for boron carbide plates and processes have been refined to produce functionally equivalent siliconized silicon carbide plates for as low as \$350 per plate. To date, this project has resulted in a cost avoidance of more than \$150M for the Army and Marine Corps.

TIME LINE / FUNDING

This project ran from October 1997 to May 2001.

Army ManTech Funding: \$0.450M. Cost Sharing was also received from: PM Soldier - \$0.570M, Marine Corps - \$0.230M, and Cercom Inc. - \$0.225M

PARTICIPANTS

Cercom Inc., Simula Inc., Specialty Defense
U.S. Army Natick Soldier Center, U.S. Marine Corps