

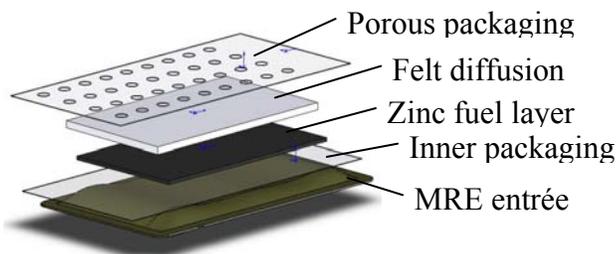
Exothermic Nanocomposite for Self-Contained Ration Heater

An air-activated heater has been developed for heating the standard operational ration, the Meal-Ready-to-Eat (MRE). The heater, a nanoparticle composite of zinc and carbon is based on the electrochemical oxidation. Essentially, the heater performs as millions of nano-batteries that are short-circuited to create heat.



By mixing zinc powder with activated carbon, and applying potassium hydroxide (KOH) electrolyte, the reaction readily occurs in atmospheric conditions. However, spreading the powder uniformly around a water bag or MRE pouch proved to be difficult. Moving or handling of the bag led to redistribution, shifting, and clumping of the powder, which makes it difficult for the oxygen to access all the Zinc material. Also, a change in the powder redistribution can lead to an unpredictable performance, non-uniform heating, and hot spots that can affect package integrity. The need to produce the heater in sheets comes from these issues.

NSRDEC and RBC Technologies have developed a process which involves mixing zinc metal powder, activated carbon, a binder, and a solvent within a mixer. The resulting ‘cake’ is passed through a set of heated rollers, which leads to fibrillation of the binder and formation of a flexible sheet that can be cut into desired shapes. These sheets are stable in air. The sheets are then treated with an electrolyte solution in an oxygen deficient atmosphere. These heater sheets are enclosed within a pouch with air access holes. A barrier sheet with a peelable seal is then applied over the access holes. The heater is activated by simply peeling off this sealing sheet. The heater does not require any other input by the Warfighter, and does not produce any undesirable byproducts, such as hydrogen. An exploded view of the heater assembly is shown below.



DellaRocca, P., L. Tinker, C. Sesock, and R. Kainthla, Air-activated Ration Heaters, Army Science Conference, 2008, HP-03, published proceedings.

Patents or other steps toward commercialization: ManTech work will be performed beginning in FY09 to reduce the cost of the heaters and establish a manufacturing base for the technology.

Contributing Agency: DoD / NSRDEC