

ABSTRACT

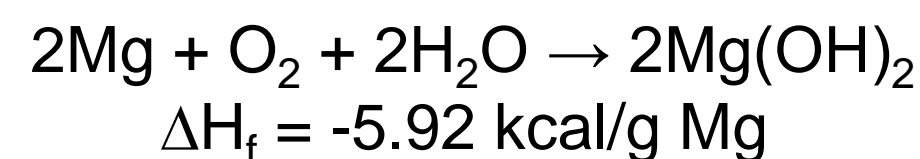
The current flameless ration heater is based on the accelerated corrosive oxidation of magnesium RBC Technologies (RBC) and the Natick Soldier RDEC have developed a flameless heater technology based on the direct oxidation of Zinc (Zn) in air.



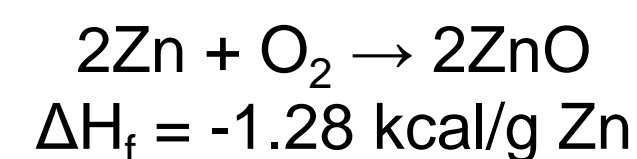
The MRE (left) utilizes the FRH (right) for heating the entrée pouch

INTRODUCTION

- Standard operational ration for the Warfighter is the Meal, Ready-to-Eat (MRE™)
- The MRE™ includes a lightweight, low cost, easy-to-use chemical heater called the Flameless Ration Heater (FRH)
- The FRH is a magnesium/iron mixture sealed in a waterproof pouch
- One ounce of water is added to the FRH to raise the temperature of one MRE™ entree by 100°F in 12 minutes

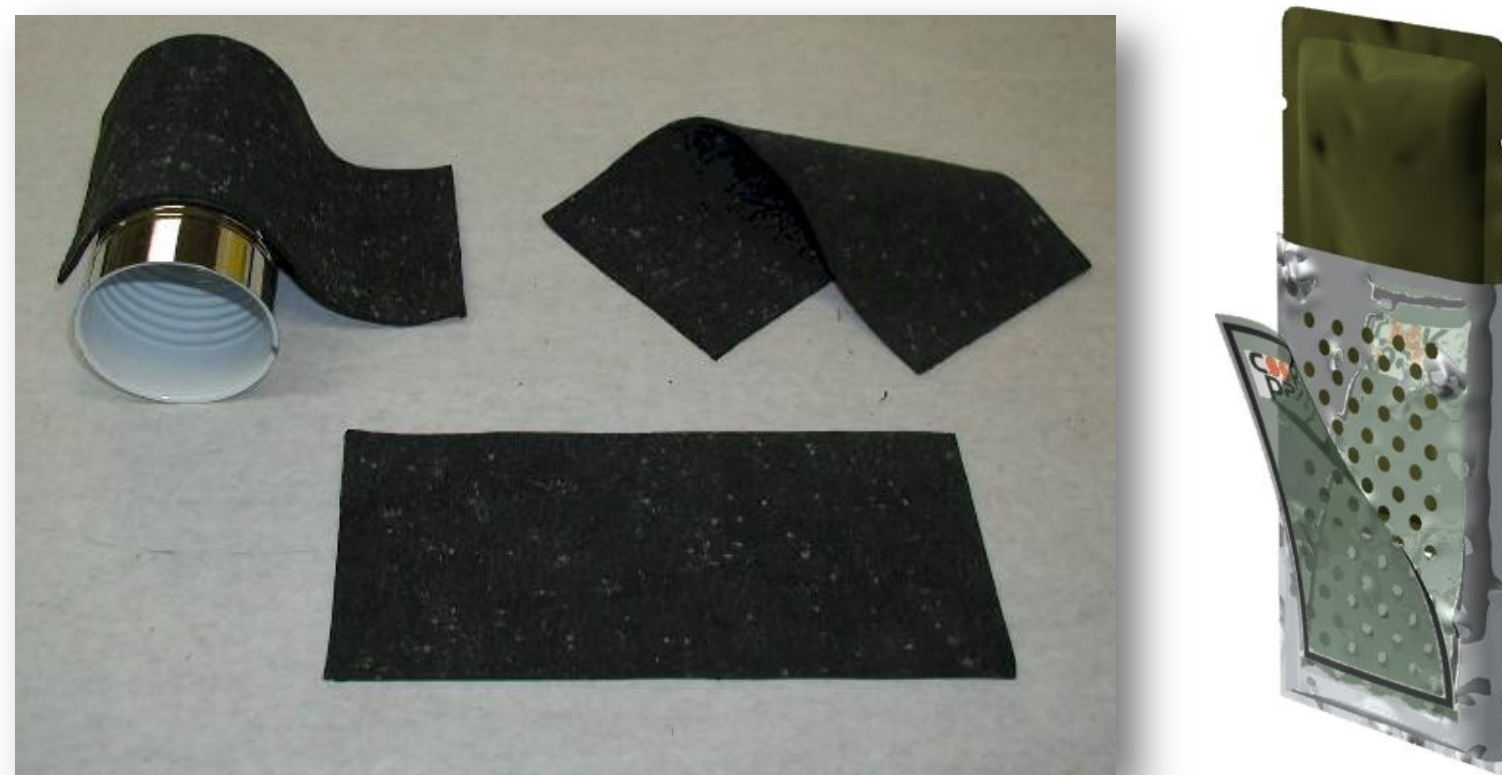


- A new heater has been developed based on the exothermic oxidation reaction of Zinc (Zn) in air:

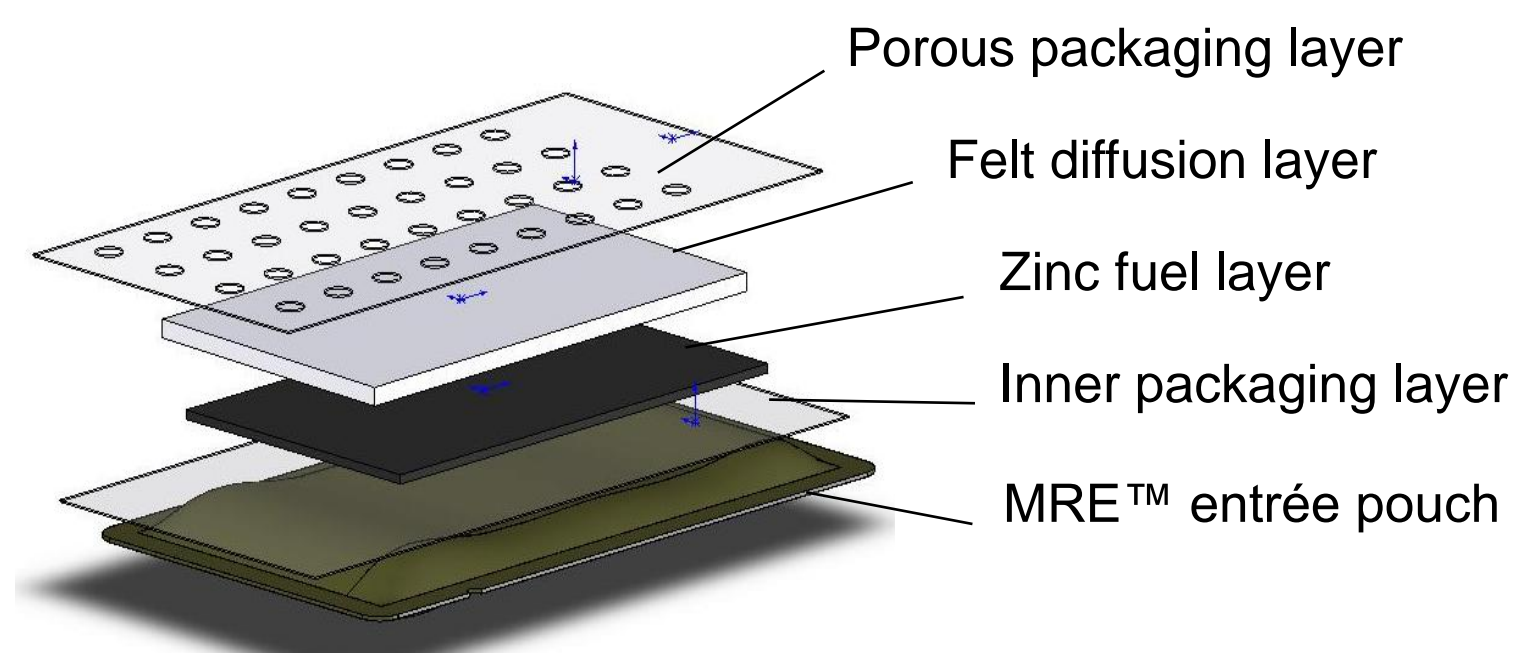


DESIGN

- The electrochemical reduction of oxygen readily takes place on activated carbon
- Zn powder and activated carbon are embedded into a flexible binder substrate
- The substrate can be rolled into sheets which can be cut, wrapped or folded into the desired form

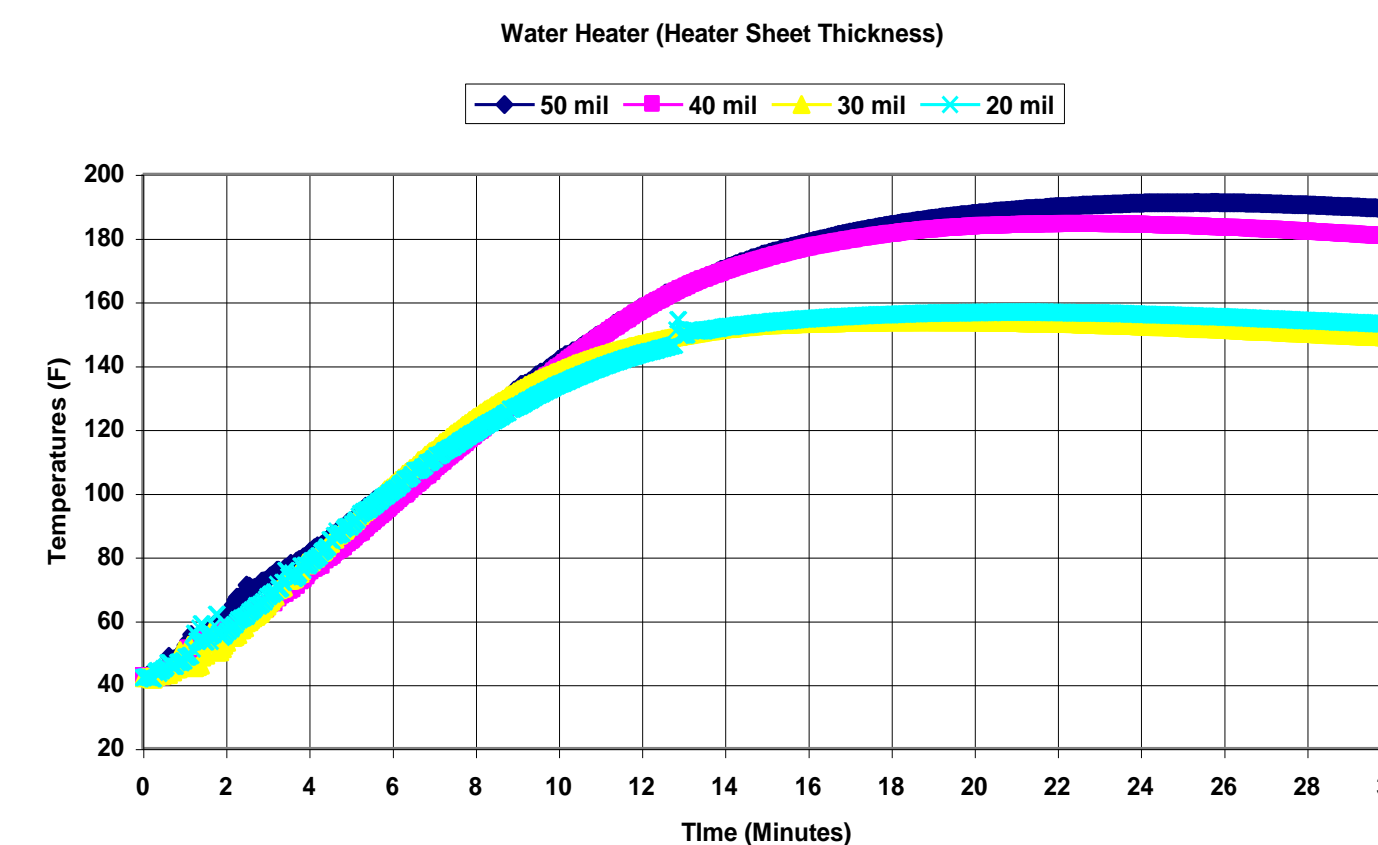


- Advantage of the heater sheet design is the robust nature of its application
- Sheets can be used to heat
 - Irregular surfaces (MRE™ entrée, water pouches)
 - Flat surfaces (polymeric trays)
 - Cylindrical surfaces (soup cans, coffee cups)



HEATING PERFORMANCE

- To meet operational requirements, heater must be capable of heating one 8 oz. (230g) entrée pouch from 40°F to 140°F within 12 minutes.
- The current Mg-based heater performs through a combination of conductive heat transfer and the latent heat of steam condensation
- Heater thickness can be used to control surface temperatures and heating profiles



PACKAGING

- Requires a film suitable for making heater pouches with a good oxygen barrier and peelable seals
- A coextruded film with a polyester layer, an adhesive layer and an EVOH EZ Peel® EVA layer meets all of the requirements
- The material provides:
 - An oxygen barrier of < 0.2 CC O₂/100in²/24 hrs @ 73°F and 0% RH
 - Water vapor transmission rate of < 1g H₂O/100in²/24 hrs at 100°F and 90% RH.



APPLICATIONS

- The military is looking at applications beyond the MRE
- The Unitized Group Ration – Express (UGR-E™), utilizes heating technology at the group ration level
 - The UGR-E™ heats 4 polymeric food trays
 - Temp increase of 100°F takes 30-45 minutes
 - Each tray holds 12-18 servings



- The Multi-serving Hot Beverage Package utilizes heating technology for group sized beverages



CONCLUSIONS

- An air-activated, flameless ration heater that utilizes the oxidation of Zinc to heat an MRE™ entrée in a reasonably simple, practical and cost-effective way has been achieved
- This heater is entirely self-contained, requiring only exposing the heater pouch to air.
- The rate of reaction or “cooking” time can be adjusted by controlling air and heater configuration.
- The heater meets all performance specifications and fits within current logistics streams