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# Combustion Characterization of Blade Cast Magnesium and Manganese Oxide

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Abstract

There is a current need for low cost heat sources for a variety of applications, from local joining and welding, to providing local heat for power sources. In this work, powders of magnesium and manganese oxide were mixed with a fluorpolymer binder and blade cast onto a steel foil substrate. The two binder-solvent systems investigated were Methyl Pyrrolidone (NMP) and Polyvinylidene Fluoride (PVDF), as well as Acetone and Viton A. Films were prepared by mixing the energetic composites with the binder and solvent to create a 40% solids content suspension, and then casting onto stainless steel foil to a 200um wet film thickness. In this study, binder content and type was varied, and calorific output, open and confined flame propagation speed was investigated for each mixture ratio. It was found that calorific output increased with increasing binder content, to a maximum observed value of 954 calories per gram, well in excess of the energy output of the Mg-MnO2 reaction, indicating participation of the binder in the exothermic reaction. Flame speed was shown to decrease with increasing binder content, with a maximum recorded value of .14 m/s for unconfined tests, and a maximum recorded value of 3.46 m/s for confined flame speed tests, which may reflect the lower heat transfer of the binder, or some mechanism that blocks propagation with increasing binder content. High speed video of the flame propagation shows significant gas generation ahead of the flame front, which may explain the observed difference between confined and open burn speeds, as the ejecta plume preheats the material in advance of the flame front.