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Tailored Solid Rocket Propellant Combustion Using Reactive Wires

Solid rocket propellant incorporating reactive wires significantly increases mass burning rates, burning surface area, and overall efficiency without producing remnant slag.

The efficiency of rocket fuel is determined by the propellant mass burning rate. Changing the propellant formulation can increase the burning rate, but only to a certain point. Adding inert wires to the propellant increases heat conduction into the propellant, but lowers propellant efficiency. The effect of inert wires is limited by their ability to conduct heat. Therefore, a rocket propellant with an increased burn rate is desirable.

Researchers at Purdue University have developed a solid rocket propellant that has reactive wires implanted throughout, resulting in a significant increase in the propellant mass burning rate. Reactive wires produce heat when burning, which ignites the surrounding propellant, increasing the burning surface area of the propellant and the overall propellant burning rate. By adding reactive wires, the burning rate can be largely controlled by the reactive wire burning rate, which can be orders of magnitude larger than the intrinsic propellant burning rate. In addition, reactive wires assist in the combustion of propellants with inherently low burning rates that otherwise would not burn fast enough to be useful in a composite propellant.

Advantages:

-Faster propellant burning rates

-Larger burning surface area

-No remnant slag

Potential Applications:

-Rocket propulsion

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