## Using Specific Heat Capacity to Engineer a Thermal Evacuation Suit to Address Heat Transfer Processes

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OBJECTIVE: To engineer a high heat conduction thermal evacuation suit that also addresses superheated gas. Suit will allow a person to escape a fire of $980^{\circ} \mathrm{C}$ \& convection heat of 32 kph for 5 min . without causing any permanent damage. METHODS/MATERIALS: Tested various silica for heat reflection \& insulation. Modified polymer to achieve the highest amt. of insulation while retaining full mobility. Created prototypes and tested them on temp. of up to $980^{\circ} \mathrm{C}$ and superheated gas up to 32 kph . Recorded their times and temp. to find their specific heat capacity and compared it against the current bunker gear used by firefighters. Test was designed to last 5 min . in a scenario that would have the user exposed to $980^{\circ} \mathrm{C}$ flames and superheated gas. Independent variables: different types of silica, polymer and Nomex. Dependent variables: time of fire/heat resistance \& superheated gas. Controlled variables: propane torch, heat gun, charcoal briquettes, measurement tools (laser digital thermometer, digital thermometer probe, \& anemometer), construction materials, \& time exposed to open flame. RESULTS: The best light-weight full mobility thermal evacuation suit has the right balance of silica and polymer with a safety layer of Nomex. This addressed a full immersion fire of $980^{\circ} \mathrm{C}$ with superheated gas while allowing full mobility without harming the user for 5 min . CONCLUSION: Refrasil UC100-48 has the ability to be a high heat insulator and a shield from direct flame. The polymer proved to be a superior insulator and barrier to superheated gas. Silica stops open flame from penetrating, but it conducts heats up to $400^{\circ} \mathrm{C}$. The polymer is a high heat insulator, which effectively delays heat transfer. The polymer also blocks any superheated gas due to its strong ionic bonds.

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[^0]:    Awards Won:
    Fourth Award of \$500

