troduction of free radicals that would inhibit the propagation of the chemical reactions of the combustion reactions.

Manufacturing of a fire-extinguishing agent according to the proposal would begin with the formulation of a suitable polymer (e.g., a polybromostyrene) that would contribute free radicals to the combustion process. The polymer would be dissolved in a suitable hydrocarbon liquid (e.g., toluene). Water would be dispersed in the polymer/toluene solution, then another hydrocarbon liquid (e.g., hexane) that is not a solvent for the polymer would be added to the mixture to make the dissolved polymer precipitate onto the water droplets. The resulting polymer-coated droplets would be removed from the coating mixture by filtration, dried, and stored for use.

Multiaxial Temperature- and Time-Dependent Failure Model
This model should be applicable to a variety of materials.

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A temperature- and time-dependent mathematical model predicts the conditions for failure of a material subjected to multiaxial stress. The model was initially applied to a filled epoxy below its glass-transition temperature, and is expected to be applicable to other materials, at least below their glass-transition temperatures. The model is justified simply by the fact that it closely approximates the experimentally observed failure behavior of this material: The multiaxiality of the model has been confirmed (see figure) and the model has been shown to be applicable at temperatures from –20 to 115 °F (–29 to 46 °C) and to predict tensile failures of constant-load and constant-load-rate specimens with failure times ranging from minutes to months.

The model is embodied in the following equation for the failure condition:

$$AP^2 J_2 + BPI_1 = 1$$

where
- *A* and *B* are parameters that define the shape of an ellipsoidal failure surface in multiaxial stress space;
- *P* is a scaling factor that accounts for the temperature and time dependences of the material;
- *J*$_2$ is the second deviatoric stress invariant, given by

$$\sigma_{11}^2 + \sigma_{22}^2 + \sigma_{33}^2 - \sigma_{11}\sigma_{22} - \sigma_{11}\sigma_{33} - \sigma_{22}\sigma_{33} + 3(\sigma_{12}^2 + \sigma_{13}^2 + \sigma_{23}^2)$$

- *I*$_1$ is the first stress invariant, given by $\sigma_{11} + \sigma_{22} + \sigma_{33}$;
- the numerical subscripts denote Cartesian coordinate axes; and
- σ_{ij} denotes the stress.
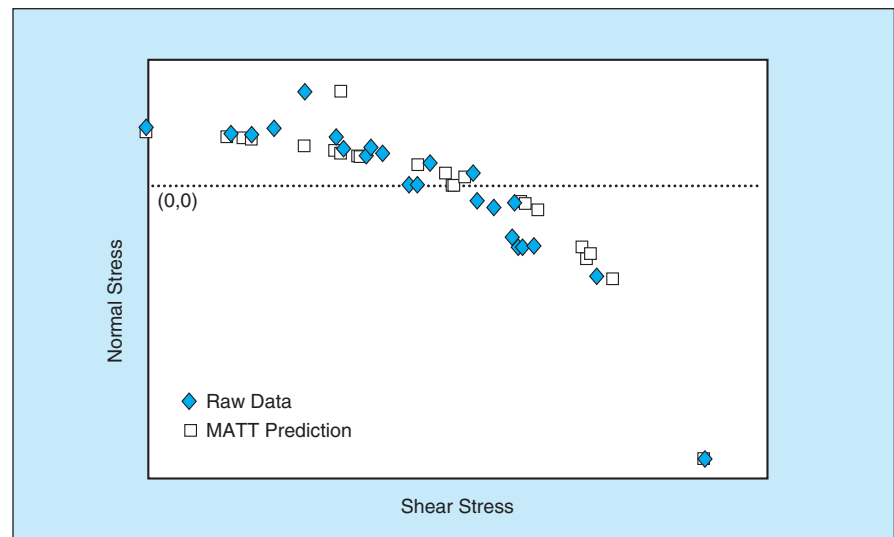
Experimental and Predicted Failure Points are plotted here for "napkin-ring" specimens of a filled epoxy that were loaded with both normal and shear stresses at a temperature of 70 °F (21 °C).

In the special case of constant *P*, this model is equivalent to a modified Drucker-Pager model, and to the Tsai-Wu failure model that is traditionally used in evaluating composite materials.

The model is calibrated by use of data from tensile and shear failure experiments. Data from tensile-adhesion and shear-adhesion failure tests of the material to which the model was initially applied show that the ratio between shear and tensile failure loads has a value of ≈0.8, independent of time and temperature. This constant ratio, in combination with one sensor data point, can be used to calculate the values of *A* (1.0 for this material) and *B* (0.31754 for this material).

The value of the scale factor *P* is simply whatever value is needed to make a given failure surface pass through a known failure point for a given temperature and failure time. Hence, for example, once *A* and *B* are known, *P* as a function of time and temperature can be determined simply by solving the basic model equation for *P* and then inserting stress values from tensile or shear tests that involve known failure times and temperatures.