

Facilities that store, process, or load the hypergolic fuels used to launch space exploration vehicles must be vigilant of employee exposure to hydrazines. Hydrazine and its derivatives are known to cause liver damage at concentrations well below the olfactory threshold of a human being. Current hydrazine sensors employ irreversible chemical reactions, making the dosimeters an expensive necessity. Development of a hydrazine sensor based on the restoration of fluorescence via hydrogen bond disruption could provide a cost-effective, highly sensitive, and re-usable method for monitoring hydrazine levels in the facilities that handle hypergolic fuels. Precedence for this type of sensor was established with the synthesis of 2,18-dithia[3](1,8)carbazolo[3](2,6)pyridinophane, or 1,8-CP. Pyridine and carbazole derivatives are used to form a macrocyclic system in which the two molecules are locked into a conformation that favors hydrogen-bonding. The effective quenching of carbazole fluorescence by pyridine in the phane system as a result of the hydrogen bond formation was approximately 80%, and quenching is thought to occur by a charge-transfer mechanism. Disruption of the hydrogen bond by ammonia and hydrazines restored fluorescence for concentrations as low as 100ppb. To significantly reduce background fluorescence and increase sensitivity, a quenching mechanism involving energy transfer should be applied. Acridine is known to quench carbazole through energy transfer, as well as form energy sinks that can quench uncomplexed carbazole molecules. The synthesis and development of 2,9-dithia-[3](4,5)acridino[3](1,8)carbazolophane as fluorescent sensor is proposed as a reversible, sensitive, and cost-efficient method for monitoring low level concentrations of hydrazines within facilities that handle hypergolic fuels.