Handout: Thermochromic Solids

CAUTIONS: Mercury compounds are toxic. Avoid creating or breathing dust. Use gloves when working with mercury compounds, and avoid eye contact. Make extra efforts to ensure that all mercury waste ends up in the proper container. Keep your work surfaces clean all times so you will not transfer mercury waste on your close

Cu_2HgI_4 preparation

In 25mL Erlenmeyer flask, prepare solution of **0.166 g** KI in 5 mL H_2O.
To the solution of potassium iodide formed, add **0.225g** HgI_2. Shake to dissolve.

In separate 25mL E. flask, dissolve **0.25g** $CuSO_4*5H_2O$ and **~0.5g** NaCl in 2mL H_2O.
To a green solution formed, add **~0.1g** of solid $NaHSO_3$, until color changes to yellow.

With Pasteur pipet, add copper salt solution to the mercury iodide - potassium iodide solution.

Vacuum filter precipitate. Wash precipitate on filter with acetone. Weight. Calculate %yield.

Take mp or decomposition point. Note temperature of color changes when heating a sample.

Ag_2HgI_4 preparation

In 25mL E. flask, prepare mercury iodide-potassium iodide solution as above described.

In separate 25mL E. flask, prepare solution of **0.170g** $AgNO_3$ in 5 mL H_2O.

Using Pasteur pipet, add silver nitrate solution to the mercury iodide - potassium iodide solution.

Vacuum filter precipitate. Wash precipitate on filter with acetone. Weight. Calculate %yield.

Take mp or decomposition point. Note temperature of color changes when heating a sample.

All mercury waste should be disposed in the labeled containers in a hood

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Ionic conductivity of Ag_2HgI_4

Into a Pasteur pipet, carefully insert “20 gauge” copper wire to block narrow opening. Wrap tightly with a teflon tape.

Put ~ ½ of amount Ag_2HgI_4 synthesized into a wide opening of the Pasteur pipet.

Use another piece of copper wire to pack thermochromic salt densely between the two copper electrodes. Wrap with a teflon tape tightly, to immobilize the electrode. Electrodes should not touch each other.

Using a multimeter (adjust to a MΩ range), measure the electrical resistance between the electrodes of the Ag_2HgI_4 sample.

Heat the solid in Paster pipet by putting it in contact with hot plate or heat it carefully on Bunsen burner and measure the electrical resistance again.

Note color change vs. conductivity change. Repeat heating several times to get the lowest resistance possible without decomposing of a sample. Check for reversibility of color changes.

Postlab questions:

1. Draw and balance all the chemical equations involved in the Cu_2HgI_4 and Ag_2HgI_4 preparations.
2. What cation or/and anion is responsible for ionic conductivity? Do you expect the Ag or Hg ions to be more mobile? Justify your answer.