The Littlest Holiday Tree

Introduction

Add a drop of clear solution to a microscope slide containing a tiny piece of copper and create a beautiful, silver-branched holiday tree that grows before your very eyes!

Concepts

- Oxidation–reduction
- Crystallization

Materials

Copper strip, Cu, 2 × 0.5 mm
Silver nitrate solution, $AgNO_3$, 0.3 M, 1 drop
Eye dropper or Beral pipet
Microscope
Microscope slide and cover slip
Microscope video camera and monitor (optional)
Scissors

Safety Precautions

The silver nitrate solution is moderately toxic by ingestion, irritating to body tissues. Avoid all body tissue contact. Silver nitrate solution will stain skin and clothing. Be careful when cutting and handling the copper sliver; it is very sharp. Wear chemical splash goggles, chemical-resistant gloves, and a chemical-resistant apron. Please review current Safety Data Sheets for additional safety, handling, and disposal information.

Preparation

Prepare a 0.3 *M* $AgNO_3$ solution by dissolving 5.1 g of $AgNO_3$ in 100-mL of distilled or deionized water or diluting a more concentrated silver nitrate solution.

Procedure

1. To make the small tree, use scissors to cut out a small triangle, about 2-mm tall and 0.5-mm wide, from the copper strip (see Figure 1).
2. Center the copper tree on a microscope slide and place the cover slip over it (see Figure 2).
3. Bring the tree into focus. Set the magnification so that the tree is centered and does not fill the entire field (see Figure 3).
4. Have each student view the tree or optionally, set up the video camera and display the tree on the monitor.

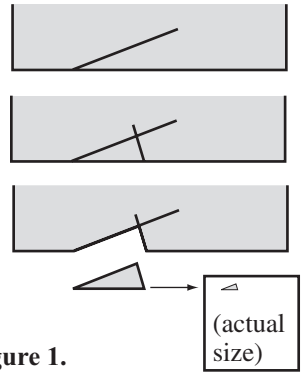

Figure 1.

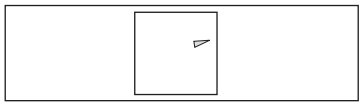

Figure 2.

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5. Add 1 drop of 0.3 M silver nitrate ($AgNO_3$) along the side of the cover slip. (see Figure 4). The solution is wicked under the cover slip and when it reaches the copper tree, dendritic silver crystals will start to grow from the edges of the copper.
6. As they grow outward, the silver crystals resemble pine tree branches and needles (see Figure 5).
7. Move the slide slightly and change magnification to follow the growth of these beautiful crystals.

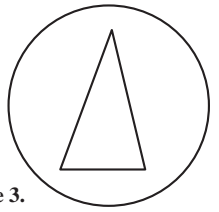

Figure 3.

Figure 4.

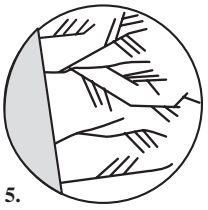

Figure 5.

Disposal

It is recommended that you consult your local school board and/or municipal regulations for proper disposal methods that may apply before proceeding.

Tips

- Use caution when cutting the copper strip to avoid any sharp edges or metal slivers.
- Switching from a back-lit image to a top-lit image will highlight the shiny silver needles.

Discussion

The "holiday tree" reaction is a single replacement, oxidation–reduction reaction, in which copper metal is oxidized to copper(II) ions and silver ions are reduced to silver metal.

$$Cu(s) + 2AgNO_3(aq) \rightarrow Cu(NO_3)_2(aq) + 2Ag(s)$$

The slide and the cover slip restrict the growth of silver crystals, creating the dendritic patterns. Silver crystals grow in thread-like spikes along the edges of the copper sliver.

Acknowledgement

Special thanks to Bob Becker, K.H.S., for providing the instructions for this demonstration.

Materials for *The Littlest Holiday Tree* are available from Flinn Scientific Canada Inc.

Catalogue No.	Description
CJ0182	Copper Strips, 1.2 × 15 cm, Pkg. of 6
SJ0025	Silver Nitrate, $AgNO_3$, 5 g
ML1382	Cover Slips, Glass, 1 oz Pkg.
ML1398	Microscope Slides, Glass, Pkg. of 72

Consult www.flinnsci.ca or your *Flinn Scientific Canada Catalogue/Reference Manual* for current prices.