
Standard Procedure SP 0006-2:2005

Chemical tests for identifying cations and anions in minerals – Part 2: Flame tests

1 Scope

This Standard Procedure uses flame tests to detect and distinguish between sodium, potassium, calcium and copper ions. It may be used for minerals and ores containing one of these ions. The presence of more than one gives mixed flame colours, which are difficult to distinguish by eye. Similarly, other cations, particularly other Group 1 and 2 metals, may interfere, giving misleading results.

2 Definitions

mineral

a naturally occurring solid, consisting mainly of one chemical with a fixed composition

ore

a mineral from which a metal is extracted on a commercial basis

cation

a metal atom carrying a positive charge

3 Principle

Compounds of certain metals give off coloured light when heated in a flame. The colour is characteristic for each metal, so the test shows which of the four cations, if any, the mineral contains. Moistening the sample with concentrated hydrochloric acid produces the metal chloride. Chlorides vaporise in the flame more easily than most metal compounds, giving a stronger flame colour.

4 Apparatus and Reagents

- watch glass
- nichrome wire with small loop at one end
- eye protection
- concentrated hydrochloric acid **CAUTION:** corrosive

5 Test Specimens

Use powdered specimens as prepared for Part 1.

6 Procedure

- Note the colour of the powdered specimen. Blue or green suggests copper ions Cu^{2+} . Colourless or white indicates the absence of copper, iron and other transition metals. Keep this information to use in Part 3.
- Put 2 drops of concentrated hydrochloric acid **CARE!** on a watch glass.
- Clean the nichrome wire loop by dipping it in the acid and heating in a Bunsen flame. Repeat until no flame colour is produced.
- Rinse and dry the watch glass. Add a quarter spatula measure of powdered specimen. Moisten with 2 drops of concentrated hydrochloric acid.
- Perform a flame test on the sample.
- If a yellow flame is produced, this may be due to sodium as an impurity in the sample. The yellow may be masking the true flame colour. Repeat the flame test, observing the flame through a piece of blue glass, which cuts out the yellow light.

7 Expression of Results

Record any distinctive flame colour, or no colour. Identify the cation as below:

Flame colour	Cation
bright yellow	sodium Na^+
lilac (pinkish purple)	potassium K^+
brick red (reddish orange)	calcium Ca^{2+}
blue-green	copper Cu^{2+}

8 Test Report

Your test report should include:

- (a) reference to this Standard Procedure;
- (b) the identity of the sample (for example, Sample A);
- (c) which cation you found in the sample.