MICkit® 4

For Qualitative Tests of Chemical Species in Corrosion Products

BTIproductsLLC

INSTRUCTIONS

Read all instructions before sample collection

Before collecting samples, review contents of this test kit (page 3). This kit allows testing of *ten* samples.

Record results in the attached MICkit® 4 Results Sheet.

This kit allows tests for the following parameters:

1. pH
2. Presence of carbonate ($CO_3^{=}$)
3. Presence of sulfide ($S^{=}$)
4. Presence of ferrous iron (Fe^{+2})
5. Presence of ferric iron (Fe^{+3})
6. Presence of calcium (Ca^{+2})

Warranty information can be found on page 3 of these instructions.

For technical assistance, to request MSDS, or to place an order:

Call Toll Free: 970.884.4629

Or E-mail: products@bti-labs.com

SECTION 1. CAUTIONS & SAMPLE COLLECTION

1A. Cautions

1. Buffer Solution contains ammonium hydroxide (NH_4OH). *Avoid contact with skin and eyes, and avoid breathing vapors!* If contact is made with skin or eyes, flush with large amounts of fresh water.
2. 2 Normal hydrochloric acid (2N HCl) is a strong acid. *Avoid contact with skin and eyes, and avoid breathing vapors!* If contact is made with skin or eyes, flush with large amounts of fresh water.
3. If Reducing Solution develops an extensive white precipitate, it must be discarded.

1B. Sample Collection

1. Use a tongue depressor to collect sample from suspected microbiologically influenced corrosion (MIC) area, mud, or soil. Place sample into 15 ml sampling tube.
2. Add deionized water (labeled "DI H_2O") up to 10 ml mark. Replace screw-cap. Shake vigorously to homogenize sample. You have just created what is known as a *slurry*.
3. Using the marking pen, label three of the 6 ml test tubes 1, 2, and 3. Use the plastic tube rack to hold your sampling tube and test tubes.
4. Use a plastic pipette to transfer 1 milliliter (ml) of the slurry created in step #2 to each of the three test tubes.
5. Proceed to Section 2.

SECTION 2. CHEMICAL TESTS

2A. pH

1. Place a strip of pH paper into slurry remaining in 15 ml sampling tube so that paper touches liquid.
2. Compare pH strip color to color chart on pH strip vial.
3. Record result.
4. Proceed to Step 2B-1.

2B. Carbonate & Sulfide

1. Without touching slurry, fold a strip of lead acetate paper over mouth of test tube #1.
2. Add 1 ml (approximately 30 drops) of 2N HCl to tube #1.
3. Place tube #1 cap on loosely over lead acetate strip. *Be careful* not to break strip.
4. A positive reaction for carbonate ($CO_3^{=}$) is indicated by bubbles in the slurry.
5. Sulfide ($S^{=}$) is present if lead acetate strip turns brown or black in color.
6. Record results.
7. Proceed to Step 2C-1.

2C. Ferrous Iron

1. Use metal spatula to add 1 milligram (mg)—a very small amount—of Ferrozine powder to test tube #2.
2. A purple color indicates the presence of ferrous ions (Fe^{+2}).
3. Record result. ***Note:*** A positive reaction for ferrous iron (Fe^{+2}) may mask the reaction for ferric iron (Fe^{+3}).
4. Proceed to Step 2D-1.

2D. Ferric Iron

1. Add entire contents of one Reducing Solution vial to test tube #2.
2. Observe sample for color development.
3. A purple color indicates the presence of ferric ions (Fe^{+3}).
4. Record result.
5. Proceed to Step 2E-1.

SECTION 2. CHEMICAL TESTS (CONT'D)

Note: If Step #2C resulted in slurry turning purple, and Step #2D intensified color, then slurry contains a mixture of ferrous (Fe^{+2}) and ferric (Fe^{+3}) ions.

2E. Calcium

1. Add 1 drop of Buffer Solution to test tube #3.
2. Using metal spatula, add 1 milligram (mg)—a very small amount—of Indicator Powder to tube #3.
3. Replace cap, and shake well.
4. A red color indicates the presence of calcium (Ca^{+2}), while a blue color indicates calcium is not present.
5. Record result.
6. Proceed to Section 3.

Rinse sampling tube, test tubes, caps, and metal spatula used in this section with DI H_2O. They will be used again for future samples. Discard used test strips, pipettes, and tongue depressors in an appropriate manner.

SECTION 3. INTERPRETATIONS

3A. General Guidelines

1. These general guidelines and explanations are given to assist users of MICkit® 4 test kits in interpreting results. These guidelines are not absolute. Users must consider all results, conditions, and variables for their own samples and situations in evaluating test data.
2. ALL tests give information ONLY about the site from which the sample was taken. Another site a few feet away may have quite different results. This is due to large variations in conditions from site to site (e.g., soil type and conditions, moisture, chemistry, microbiology, coating condition, level of cathodic protection (CP), degree of shielding, etc.). All chemical, biological, physical, historical, and operational data should be considered when making a diagnosis.
3. The data must be taken together to form the most accurate diagnosis. Since most forms of localized corrosion of steels result in some acidity, the presence of iron (especially ferrous iron), and, in general, an absence of carbonate and calcium scale, these parameters cannot be used alone to arrive at a definitive diagnosis of MIC, nor can they be used to rule out MIC. If, however, sulfide and MIC-related microbes are also present, it is a clear indication of active MIC. MIC sites which were active in the past may ultimately appear like non-MIC sites as MIC-related microbes, ferrous iron, and lower acidity disappear from the site—possibly in response to changes in the local environment at the site (change in moisture, CP, etc.).
4. Also look at metal at the corrosion site. IF metal under the deposit is shiny, it is a clear indication of active corrosion.
5. Mill scales exposed to an oxidizing environment can form rust-type corrosion products containing mostly ferric iron. These may be more generally distributed over the surface. The presence of small amounts of such surface-related, non-discrete, deposit-type materials is normal under many service conditions.

3B. Interpretations

1. **pH:** In general, the lower the pH, the more corrosive the environment and the less likely that CP is working at that particular site.
2. **Calcium:** Presence of calcium in deposits, soil, and/or corrosion products indicates the potential for formation of scale. Some scales can help protect sites from corrosion.
3. **Carbonate:** If present, carbonate indicates the potential for formation of scale and is potentially a good thing.
4. *IF alkaline pH, calcium, AND carbonate are ALL present* in a sample, calcium carbonate-type scales can form or may have already formed. These type scales tend to protect against corrosion. On items protected by CP, alkaline pH, calcium, and carbonate are an indication that CP is working—at least at that particular site. However, this does NOT mean that CP is working on all portions of the equipment.
5. **Ferrous iron** in deposits and corrosion products indicates reducing conditions (lack of oxygen at the site) and is an indication of possible microbiologically influenced corrosion (MIC).
6. **Ferric iron** is an indication of oxidizing conditions, even in mill scale which has been exposed to the environment. If the ONLY form of iron in the corrosion products is ferric, it is one indication that MIC is not presently active at that site. In MOST cases, corrosion products at MIC sites contain ferrous iron on the inside of deposits and ferric iron on the outer surface of the deposits (where the iron is exposed to oxygen).
7. **Sulfide:** Presence of sulfide in deposits and corrosion products is a clear indication of MIC.

MICkit® 4: List of Kit Contents

1. 1 Storage Box
2. 1 Tube Rack
3. 1 Bottle Deionized Water—Labeled "DI H_2O" (250 ml)
4. 2 Bottles Dilute Acid—Labeled "2N HCl" (10 ml)
5. 1 Vial Ferrozine Powder (0.1 g)
6. 1 Bottle Buffer Solution (10 ml)
7. 1 Vial Indicator Powder (0.4 g)
8. 10 Vials Reducing Solution (0.5 ml)
9. 1 Vial Lead Acetate Test Strips
10. 1 Vial pH Test Strips
11. 5, 6 ml Test Tubes with Snap Caps
12. 1, 15 ml Sampling Tube with Screw Cap
13. 15 Plastic Transfer Pipettes
14. 15 Tongue Depressors
15. 1 Metal Spatula
16. 1, 250 ml Bottle for Liquid Waste—Labeled "Waste"
17. 1 Marking Pen

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WARRANTY

BTI Products, LLC's products are warranted by **BTI Products, LLC** to perform as described in the technical literature supplied with each product, provided the products are used, stored, and maintained in accordance with the directions provided. They must also be used before the expiration date. Adequate quality control must be done by the user of the products.

BTI Products, LLC disclaims any implied warranty of merchantability or fitness of its products for any other purpose than described in its technical literature, and in no event shall **BTI Products, LLC** be held liable for any consequential damages arising out of the aforesaid express warranty.

Should you have questions about this product or any of the products and services we provide, please call or write:

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We welcome all comments and inquiries.

Usage & Storage: Use by expiration date printed on kit box label. Store test materials in a cool, dry place out of direct sunlight. Do not eat or drink any of the contents of the kit. Keep out of the reach of children. Material Safety Data Sheets available upon request.

Disposal of Test Materials: Properly dispose of all kit components. Needles must be destroyed before disposal by cutting or bending back the needle. Syringes must be destroyed by breaking or shattering the barrel. Federal and local laws apply.

Used media bottles must be properly disposed of according to local regulations. Alternatively, bottles/kits may be returned to **BTI Products, LLC** for proper disposal for a fee of $30.00 per kit.

Need Help?

Call 970.884.4629

MICkit® 4 Results Sheet

Sample #	Sample Description	pH	Carbonate ($CO_3^{=}$) Bubbles = (+) for $CO_3^{=}$ No Bubbles = (-) for $CO_3^{=}$	Sulfide ($S^{=}$) Black/brown color = (+) for $S^{=}$	Ferrous Iron (Fe^{+2}) *Ferrozine Reaction:* Purple color = (+) for Fe^{+2}	Ferric Iron (Fe^{+3}) *Reducing Solution Reaction:* Purple color = (+) for Fe^{+3}	Calcium (Ca^{+2}) Red color = (+) for Ca^{+2} Blue color = (-) for Ca^{+2}
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Comments:

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