# Educational Innovations®

## #FF-400

# Ferrofluid Bolt Kit

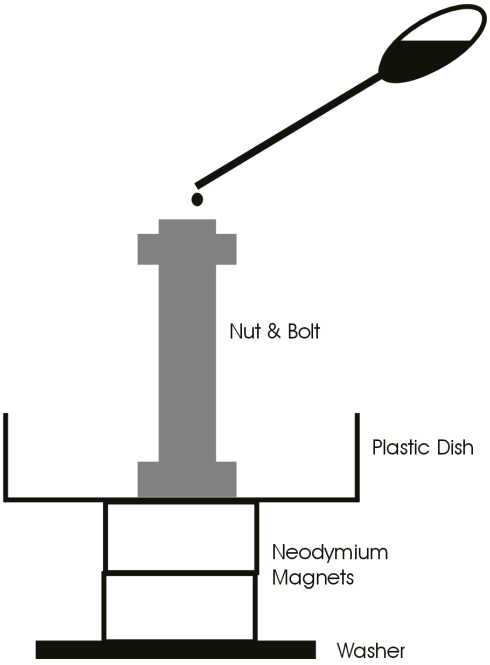
When a black liquid is slowly dropped on the top of a magnetized bolt, numerous spikes form.

**Safety Precautions:**

1. Neodymium magnets are extremely strong and unexpectedly can attract other magnets or pieces of ferrous metal. Often this results in pinched fingers and flying chips from the magnets.

2. Safety glasses, rubber gloves, and protective clothing must be worn whenever using neodymium magnets and ferrofluid. When neodymium magnets collide with an object, they sometimes chip and ferrofluid will permanently stain surfaces such as tabletops, clothing, skin, or eyes.

3. Do not bring a magnet close to the liquid ferrofluid, as it will cause the ferrofluid to jump to the magnet.




**Instructions:**

1. Carefully, attach the large washer to one of the flat surfaces of the two neodymium magnets. This gives the base stability.

2. Set the plastic dish on the top surface of the magnets and secure with the nut and bolt assembly.

3. Slowly drip the ferrofluid, a drop at a time, onto the TOP of the assembly, keeping the pipet well away from the magnets at all times. Numerous spikes should form. WARNING: if you add the ferrofluid too quickly, it may make a mess.

When finished, use the pipet to draw up the ferrofluid and return it to its bottle.

**Things to Try:**

Bring a magnet to within 12" of the ferrofluid on the bolt and observe the effect on the spikes. What happens when you move this magnet? What is the greatest distance a magnet can affect the spikes? Repeat with another magnet. Using the two distances and the Inverse Square Law, determine the relative strengths of the two magnets.

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# MATERIAL SAFETY DATA SHEET

Display Cell consists of 2 components: a clear liquid containing alcohol and water, and a small amount of black/brownish color liquid called ferrofluid. This MSDS pertains to the ferrofluid in the Display Cell. For the clear liquid there is a separate MSDS.

## SECTION I: PRODUCT IDENTIFICATION

**MANUFACTURER'S NAME:** Ferrofluidics Corporation
**ADDRESS:** 40 Simon Street
Nashua, N.H. 03061
**EMERGENCY TELEPHONE:** (603) 883-9800 (X-212)

**CHEMICAL NAME:** Proprietary Product
**TRADE NAME & SYNONYMS:** DISPLAY CELL-FERROFLUID
**CHEMICAL FAMILY:** Colloidal Dispersion
**FORMULA:** Mixture

## SECTION II: COMPONENTS

The precise composition of this ferrofluid is proprietary information. This material has low toxicity. It is NOT recommended for human consumption. A more complete disclosure will be provided to a physician or nurse in the event of a medical emergency.

**Magnetite:** 5-6 % by volume
**Oil Soluble Dispersant:** 15-19 % by volume
**Fluorocarbon Carrier:** 75-80 % by volume
PS=The volume of magnetic fluid in the Cell is 6-8%

## SECTION III: CHEMICAL AND PHYSICAL PROPERTIES

**Boiling Point (°F):** 194-225
**Specific Gravity:** ~2.1
**Vapor Pressure (mm Hg.):** 42 at 20°C
**Percent Volatile by Volume:** 75-80 %

**Vapor Density (AIR = 1):** 14
**Solubility in Water:** None
**Evaporation Rate at:** >1 (Butyl Acetate=1)
[$4.3 \times 10^{-5}$ gm/cm $^2$ sec at 22°C]
**Appearance & Odor:** Black, odorless liquid

## SECTION IV: FIRE AND EXPLOSION HAZARD AREA

**Flash Point (°F):** None
**Method:** Not Applicable

**Flammable Limits:** uel: Nonflammable
lel: Nonflammable
**Extinguishing Media:** Nonflammable

**Special Fire Fighting Procedure:** When fire-fighting conditions are severe and total thermal decomposition of the product is possible, wear full protective clothing, including helmet, self-contained, positive pressure or pressure demand breathing apparatus, bunker coat and pants, bands around arms, waist and legs, face mask, and protective covering for exposed areas of the head. No unusual effects are anticipated during fire extinguishing operations. Avoid breathing the products and substances that may result from the thermal decomposition of the product or the other substances in the fire zone. Keep containers cool with water spray when exposed to fire to avoid rupture.

**Unusual Fire and Explosion Hazard:** Exposure to extreme heat can give rise to thermal decomposition.

**Unusual reaction hazard:** None

**NFPA Hazard Codes:** Health – 1
Fire – 0
Reactivity – 0

## SECTION V: HEALTH HAZARD AREA

**Threshold Limit Value:** Not determined. 5mg/m$^3$ for oil mist in air (OSHA Regulations 29 CFR 1910-1000).

**Emergency and First Aid Procedures:**

**Skin Contact:** Wash affected area with soap and water.

**Eyes:** Immediately flush eyes with large amounts of water. Get immediate medical attention.

**Inhalation of Smoke or Mist:** If signs/symptoms occur, remove person to fresh air. If signs/symptoms continue, call a physician.

**If Swallowed:** Get immediate medical attention.

**Other First Aid:** This product is not expected to be irritating to the eyes, skin or respiratory system at room temperature conditions. This assessment does not account for contaminants from product use. The suggested first aid measures are basic first aid measures for removal of foreign materials from the skin and/or eyes.



## SECTION VI: REACTIVITY DATA

**Stability:** Unstable [ ] Conditions to Avoid: Prolysis
Stable [x]

**Incompatibility (materials to avoid):** Strong oxidizing materials, heat, and flame. Finely divided active metals, Alkali a alkaline earth metals.

**Hazardous Decomposition Products:** If the product is exposed to extreme condition of heat from misuse or equipment failure, toxic decomposition products that include hydrogen fluoride and perfluoroisobutylene can occur.

Hydrogen fluoride has an ACGIH threshold limit value of 3 parts per million parts air, ppm, of fluoride as a ceiling limit and an OSHA PEL of 3 ppm of fluoride as a eight hour time-weighted average and 6 ppm of fluoride as a Short Term Exposu Limit.

Perfluoroisobutylene has an ACGIH threshold limit value of 0.01 parts per million parts of air as a ceiling limit or 0.082 milligrams per cubic meter as a ceiling limit.

## SECTION VII: SPILL OR LEAK PROCEDURES

**Steps to be taken in case material is released or spilled:** Remove free liquid. Add absorbent (sand, earth, sawdust, papertowel) to spill area. After removing absorbent, wash surface with soap and water to reduce possible slipping hazard.

**Waste Disposal Method:** As a disposal alternative, incinerate in the presence of a combustible material in an industrial c commercial facility capable of handling halogented waste. Reclaim if feasible. Small amounts may be left to evapora off in a fume hood at room temperature.

## SECTION VIII: SPECIAL PROTECTION INFORMATION

**Respiratory Protection (Specify Type):** None required unless smoke, mists, or vapors are produced.

**Ventilation:** No special ventilation required.

**Protective Gloves:** If required to prevent prolonged or repeated skin contact.

**Eye Protection:** Safety glasses, if splash is possible.

**Other Protective Equipment:** Not needed.

## SECTION IX: SPECIAL PRECAUTIONS

**Precautions to be taken in handling and storing:** Ordinary care in handling chemicals. Wash hands after handling.

**Other Precautions:** Avoid contamination of tobacco products. Users should be aware that a very small percentage of the population may display unexpected allergic skin reactions to otherwise innocuous industrial chemicals and raw mater

## SECTION X: COMMENTS

* This product DOES NOT contain any materials considered to be carcinogenic by any recognized sources.

** This material is not sold for use in products for which prolonged contact with skin or implantation in the human body i intended. Ferrofluidics Corporation does not recommend this material as safe and effective for such uses and assur no liability for any such use.

*** This product does not contain any chemical subject to the reporting requirements of Section 313 of Title III of the Superfund Amendment and Reauthorization Act of 1986 and 40 CFR Part 372.