Magnetic Imaging of Ongoing Corrosion Activity in Aircraft Lap Joints

- Corrosion DAMAGE can be detected by various NDE techniques.
- Corrosion ACTIVITY can be studied for exposed corrosion using standard electrochemical techniques.
- Only SQUIDs can detect ongoing hidden corrosion activity, as in an aircraft lap joint.

Vanderbilt Corrosion SQUID System

SQUID image of corrosion activity
Summed magnetic activity versus time for old aircraft lap joints

- Reproducible dry background
- Low activity in 98% relative humidity air
- Distilled H₂O activates the chemistry within the lap joint
- 0.01 M chloride shows higher activity
- SQUIDs provide a unique research tool for studying hidden corrosion
High Resolution LTS-SQUID Microscope for Room-Temperature Samples

Dewar Cross-section

LHe-Reservoir

Nb-SQUID Housing

Cu-Cold Finger

Bellows

Sapphire Bobin

Sapphire Window

77 K Shield

Pickup Coil

Field sensitivity
500 um diameter pickup coil

Field sensitivity
500 um diameter pickup coil

4K-300K Sensor-Sample Spacing < 100 µm

Field sensitivity
350 fT/Hz^{1/2} @ f>1Hz
Remanent Magnetization of Martian Meteorite ALH 84001

Propagation of Action Currents in Cardiac Tissue

Crust from reentry
Fine structure that was not annealed upon reentry

1 ms after stimulus
4 ms
10 ms
16 ms