Opportunity Title: ORNL Corrosion Materials Characterization Laboratory Technology Associate
Opportunity Reference Code: ORNL19-LabTech-MSTD-08

Organization Oak Ridge National Laboratory (ORNL)

Reference Code ORNL19-LabTech-MSTD-08

Description Oak Ridge National Laboratory (ORNL) is the largest US Department of Energy science and energy laboratory, conducting basic and applied research to deliver transformative solutions to compelling problems in energy, environment, and security.

The next frontier in vehicle body light-weighting could make extensive use of magnesium alloys (Mg) for its outstanding stiffness- and strength-to-weight, with aluminum (Al) alloy sheet providing low-cost paintable class-A finish surfaces. Already the Lincoln MKT and Chrysler Pacifica liftgates have used cast magnesium inner and aluminum sheet outer components, and the Magna-FCA next generation ultra-light door will likely use similar materials.

Corrosion of Al-Mg fusion welds is a serious problem, limiting widespread use of this material pair in the vehicle body (steel self-piercing rivets in Mg would create more severe corrosion). Friction stir welding (FSW) leads to significant grain refinement, second-phase refinement, homogenization, and densification; all characteristics known to have beneficial effects on the corrosion resistance of light metals. Aluminum corrosion studies suggest grain refinement via equal-channel angular pressing improves corrosion resistance primarily via impurity breakup and homogenization leading to reduced microgalvanic current. Similarly, FSW in wrought Mg-Y Rare earth and AA5083 aluminum alloys shows potential for improved corrosion resistance likely due to breakdown and dispersion of intergranular precipitates reducing the mass loss rate.

WPI will be the lead institution, conducting modeling and corrosion/mechanical testing as well as project management and coordination. Magna has specified 6022 aluminum (Al) and ZEK100 magnesium (Mg) alloy sheet for joints, and will provide materials as well as guidance throughout the project. Pacific Northwest National Laboratory will produce weld coupons using these materials, including fusion welds (e.g. resistance spot welds) and FSW joints, some of the latter of which will use excess energy to study the effect of FSW with partial melting. Oak Ridge National Laboratory will conduct characterization including scanning transmission electron microscopy, small-angle neutron scattering, 3-D element and grain orientation mapping using energy-dispersive X-ray spectroscopy (EDS) and electron backscatter diffraction (EBSD) with plasma ion etching, as well as scanning transmission electron microscopy(STEM). Based on this validated model, the team will endeavor to design low-cost robust joints to enable use of this strong lightweight material combination in multiple vehicle body applications.

The Center for Nanophase Materials Sciences Division (CNMS) is seeking an associate to aid ORNL in achieving the stated characterization goals above. The associate will be trained to use the scanning electron microscope (SEM) and attached X-ray energy dispersive spectrometer

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(EDS) to determine the structure and elemental composition of the base materials, weld zone constituents and corrosion products. Both experimental SEM/EDS data acquisition and subsequent SEM/EDS data analysis will be required, as will preparation of data summaries to be disseminated to project team.

Qualifications The candidate should have started gaining credits towards an engineering degree. Core course completion and a satisfactory GPA are desired.

Preferred:

- Excel spreadsheet
- PowerPoint presentation generation
- Digital image analysis
- Scanning electron microscope (SEM) characterization
- Database creation
- Python coding
- Excellent written and verbal communications skills.

Living in East Tennessee: While the opportunity to work at ORNL is an amazing experience in itself, it's easy to overlook everything else East Tennessee has to offer if you haven't had the opportunity to spend time here. From spending your weekends downtown at Knoxville's farmers market, the Rhythm n' Blooms Music Festival, or the Dogwood Arts Festival, to some of the best hiking, kayaking, and camping in the U.S, East Tennessee has something to offer everyone.

The ORNL Laboratory Technology Associates Program is administered by Oak Ridge Associated Universities through its contract with the U.S. Department of Energy to manage the Oak Ridge Institute for Science and Education (ORISE).

Eligibility Requirements

- **Degree:** Currently pursuing an Associate's Degree.
- **Discipline(s):**
  - **Engineering** (1 👁)

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