Objectives:

As proton accelerator particle sources (target facilities) become increasingly powerful, there is a pressing need to better understand and predict the radiation response of structural window and target materials. The RaDIATE collaboration will draw on existing expertise in related fields in fusion and fusion research to formulate and implement a research program that will apply the unique combination of facilities and expertise at participating institutions to a broad range of high power accelerator projects of interest to the collaboration. The broad aims are threefold:

- to generate new and useful materials data for application within the accelerator and fusion/fission communities
- to recruit and develop new scientific and engineering experts who can cross the boundaries between these communities
- to initiate and coordinate a continuing synergy between research in these communities, benefitting both proton accelerator applications in science and industry and carbon-free energy technologies

MoU Participants

With interest from:
- Los Alamos National Laboratory
- University for Rare Isotope Beams – MSU
- CERN
- Contact P. Hurh (hurh@fnal.gov) if interested in participating

Materials of Interest

- Beryllium
  Motivated by use as neutron target (MiniBooNE, LBNF) and high-intensity beam windows
- Graphite
  Motivated by use as neutron target (NuMI/ NOvA) and ion beam target (FRIB)
- Tungsten
  Motivated by use as spallation target (ISIS, ESS)
- Titanium Alloys
  Motivated by use as beam window (T2K/ParC) and structural containment (FRIB)
- Other
  It is anticipated that other materials may be added as appropriate for future facilities

Scope and Program Descriptions
- Monthly Meeting minutes and presentations
- Participant contact information
- Irradiated Materials Table
- Accelerator target parameter space table
- Other reports and links
- Radiate mailing list (RaDIATE@fnal.gov)

An exploratory study is currently underway at Oxford, Manchester, and Culham to identify and characterize the current understanding of radiation damage effects in beryllium, graphite and tungsten. From this, an experimental program for expanded testing will be developed, utilizing both previously irradiated materials and newly irradiated materials (high energy proton and fast ion beam). Areas of research particularly relevant to the accelerator target parameter space have been identified by the ongoing exploratory study to include:

- Helium and hydrogen production; bubble swelling
- Irradiation growth
- Irradiation hardening, irradiation embrittlement
- Fracture toughness
- Thermal creep, irradiation creep and stress relaxation
- Cyclic stressing (fatigue effects)
- Thermal conductivity
- Thermal expansion
- Oxidation

Other Reports and Links

- Materials science expertise in radiation damage effects (Oxford, PNNL, BNL)
- Target and irradiation design expertise (Fermilab, PNNL, STFC, BNL)
- Remote handling and hot testing expertise (PNNL, BNL)
- Beam irradiation capabilities (BNL, Fermilab, PNNL, STFC)
- Advanced testing techniques (Oxford, BNL, PNNL)
- Micro-mechanics expertise (Oxford)

Web-site

www-radiate.fnal.gov

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