Fusion Materials Science & Technology discussion summary

- 35 participants
- Multiple presentations promoting - discussing wall/PFC materials:
  - W-containing multi-component alloys, aka Refractory High-Entropy Alloys (RHEAs)
  - UHTCs
  - W/W based alloys/composites
  - SiC
  - Cr

- Engaged discussion and dialogue about options, testing environment

- No clear consensus on highest priority wall material, research goals or activities in DIII-D wall changeout.
  - W is doable, but already installed in several devices (uniqueness?)
  - SiC may be reasonable intermediate material selection but no perceived path to power plant (low thermal conductivity following irradiation)

- Limited discussion of liquid walls based on consideration of NSTX-U scope

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- Staged testing towards innovative materials solution is recommended
  - DIMES (*in conjunction with linear device/HHF testing*), divertor tiles/rings and full divertor (rapid change out), but limited by C-influence on SOL plasma & impact on erosion (perhaps not so different than wall conditioning impurities w W walls?)
  - Pending wall change out (to reduce background C & provide headroom for core radiators); logical to proceed with intermediate path of SiC limiters (and possibly first wall) and staged testing of innovative materials (as rapidly as possible):
    + Ultra-High Temperature Ceramics (perhaps Carbon-based)
    + Novel W-based composites &/or W-Cr based multi-component alloys
    + Evaluation of Cr (or Mo) first wall to further reduce background C
    + Watch emerging national program on innovative materials development
  - Minimize need for immediate (& potentially expensive) diagnostics changeout

- Depending on development path (UHTCs vs. W-based composites/RHEAs vs innovative solutions), decision on full wall changeout to intermediate or high-Z metal to:
  - provide a background for further innovative material tests in divertor - easier to flip materials in key sections such as divertor year to year or even quarter to quarter.

DIII-D Alignment, Approaches and Resources

- Expanding materials testing (staged approach) in DIII-D divertor region would significantly increase DIII-D role in materials testing, and staged approach lowers risk of impact on DIII-D operations. Remains in scope of DIII-D mission

- Alignment with bold decadal vision dependent on schedule of wall changeout (reduction of background C density in SOL plasma), aggressiveness of implementing staged materials testing approach and engagement of private sector
  - Priority of materials testing relative to other DIII-D facility activities not discussed

- Approaches and Resources not addressed but require further consideration