NASA SBIR/STTR Technologies

Efficient Long-Life Biocidal Condenser

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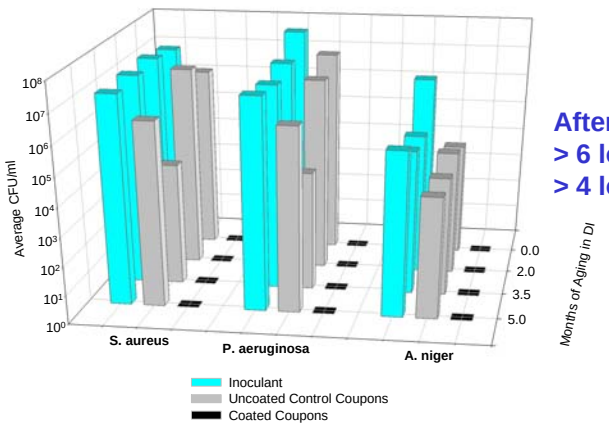
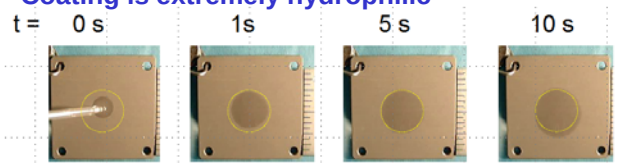
Identification and Significance of the Innovation

- Condensing heat exchanger (CHX) for ECLSS
  - Controls humidity by condensing moisture from cabin air
  - Hydrophilic coating needed for efficient and reliable performance
  - Attractive breeding ground for microbes—must be biocidal
  - Coating in the space station CHX is coming off the surface
- Innovation: Novel coating and heat transfer surface
  - Coating forms very strong bonds with surface
  - Simple to impregnate with Ag+ ions for biocidal action
  - Provides long-term hydrophilic and biocidal surface properties
  - Can be applied directly to complex heat exchanger surfaces
- Builds on established condenser design
- Current TRL: 5



After 5 month exposure:
> 6 log reduction in bacteria
> 4 log reduction in fungi

Coating is extremely hydrophilic



Coated Plate-Fin HX Structures

Accomplishments

- Coating process
  - Can produce highly adherent, crystalline zeolite coatings on prototypical materials in prototypical geometries (plate-fin HX)
- Coating hydrophilic properties
  - Highly wetting after five month exposure to prototypical environments
  - Simple to restore wettability after contamination
- Coating antimicrobial properties
  - After five month aging exposure to DI water:
    - > 6 log reductions in gram positive and gram negative bacteria
    - > 4 log reduction in fungus
- Coating stability
  - Low potential for downstream scale deposition
  - Identified potential life-limiting mechanisms; further testing required

NASA and Non-NASA Applications

- NASA Applications/Space Exploration
  - ECLSS for manned lunar and/or planetary bases
  - ECLSS for future manned spacecraft
  - Space Station upgrades to replace existing condensing heat exchanger or apply new coatings to existing CHX
- Non-NASA applications
  - Water management for fuel cell power systems
  - Hydrophilic coatings for any condensing heat exchanger
  - Biocidal coatings for any water heat transfer surface
  - Coatings for compact heat exchanger/reactors

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NON-PROPRIETARY