Ames Air Revitalization

Presented to the Bioastro Seminar
CU Boulder
Dec. 9, 2015
Topics

• Carbon Dioxide Removal and Compression System (CRCS)
• CDRA 4 Silica Gel bed testing
• Adsorption research
CRCS

• Competitive technology to CDRA-Compressor system for CO2 recovery and compression from cabin air

• Problems with CDRA
  • Zeolite dusting causing valve and compressor clogging/failure

• Problems addressed with CRCS
  • Built-in compression
CRCS

- Final assembly of A and B units
- Bed packing and assembly of A unit for half system testing
- Full system integration
Silica Gel Drying Bed

H2O Breakthrough Curves
Silica Gel Drying Bed

Breakthrough Bed RTD Temperature
Adsorption Research

• Evaluate sorption materials for CO2 and H2O adsorption under varying conditions
• Generate isotherm curves and compare/feed data to MSFC for simulations
• New toys
  • Micromeritics ASAP 2020 volumetric adsorption analysis system
  • Surface Measurement Systems DVS Vacuum gravimetric adsorption analysis system
Adsorption Research

13X ISOETHERMS AT 25C

The diagram shows the adsorption isotherms at 25°C for various samples labeled as USC 544 Sept. 2015, Amex M11 Tef Mat 100mg Nov 18, 2015, etc. The x-axis represents pressure (kPa), ranging from 0.001 to 1000, while the y-axis represents adsorption capacity (mg/g). The curves indicate different adsorption behaviors and capacities across the samples.
13X Isotherms at 25°C
Adsorption Research

ASAP 2020

DVS Vacuum
Questions?
The Carbon Dioxide Removal and Compression System (CRCS) Full Cycle

Dry cabin air

CRCSa
- CO₂ absorption to CRCSb Stage 2
- CO₂ desorption to CRCSb Stage 2
- CO₂ adsorption from Cabin Air
- CO₂ desorption from Cabin Air
- CO₂ desorption from Standby
- CO₂ adsorption from Standby

CRCSb
- CO₂ adsorption from Cabin Air
- CO₂ desorption to CRCSa Stage 1
- CO₂ desorption to CRCSa Stage 2
- CO₂ desorption to Standby
- CO₂ adsorption to Standby

Standby
- 0 minutes/120 minutes
- 60 minutes

Airsave (Vacuum)
- Inner circle = Stage 1
- Outer circle = Stage 2

Sabatier
- CO₂ (20psia)
- Dry cabin air

Free air
- 60 minutes