

CO₂ Capacity Sorbent Analysis Using Volumetric Measurement Approach

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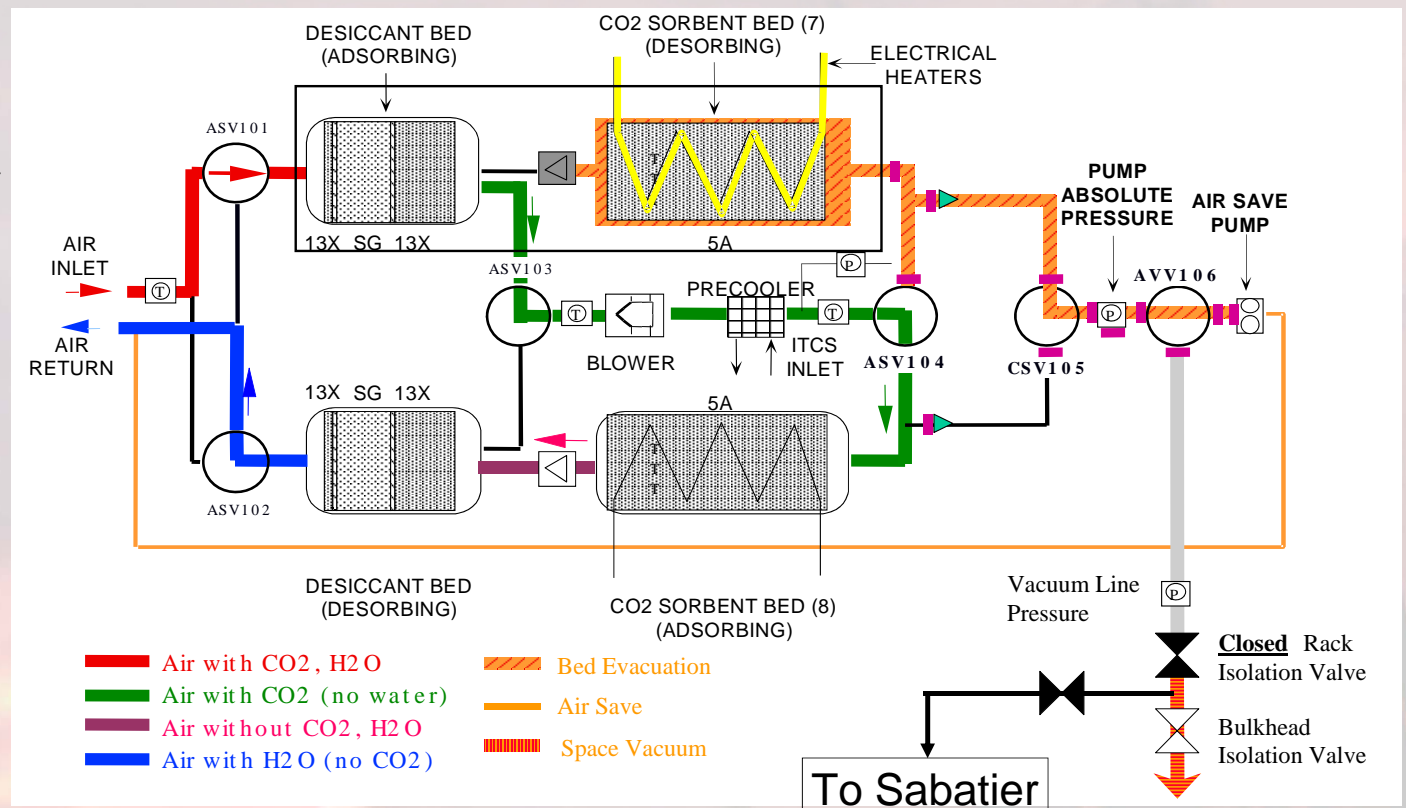


Outline

- Background
- Analysis Instrumentation
- Sorbent Characterization
- Possible Improvements

Background

- Molecular sieve
- Carbon Dioxide Removal Assembly
- 4BMSX



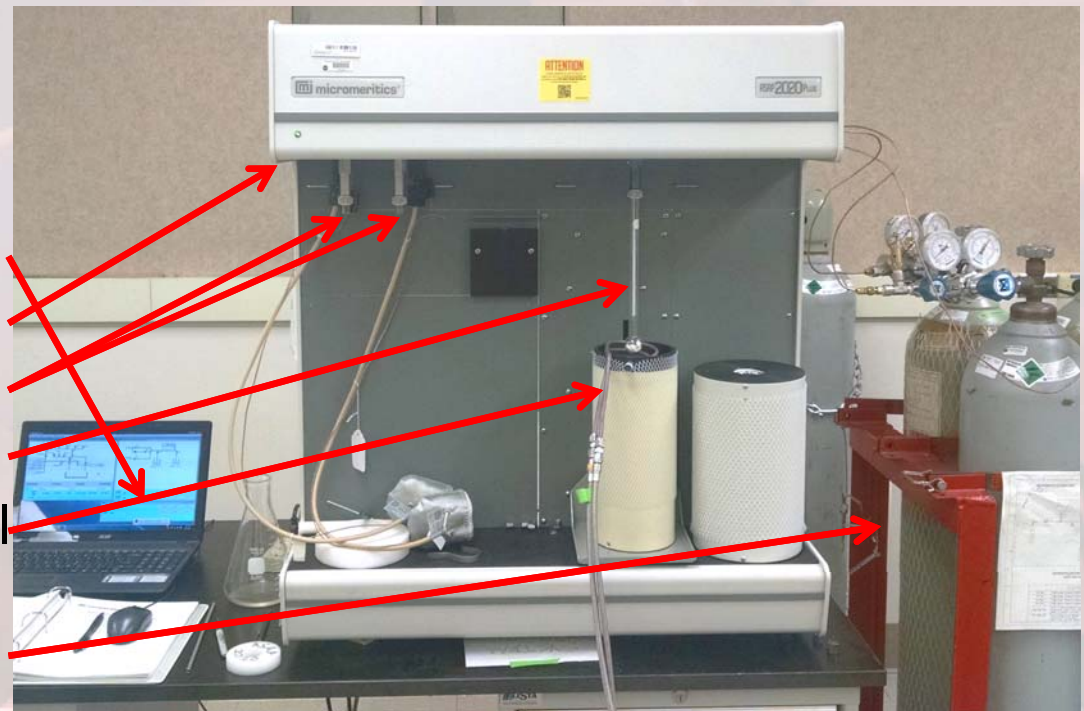
Research Motivation

- Challenges with current SOA
 - Dusting
 - Availability
- Opportunity for improvement
 - Mass
 - Volume
 - Robustness
- Sorbent characterization efforts
- Mechanical crush strength (MSFC)
- H₂O and CO₂ adsorption capacity (ARC)
 - Silica Gel
 - Zeolite



Analysis Instrumentation

- Micromeritics ASAP 2020
- Volumetric adsorption capacity analysis
- P min 4mTorr
- T range
- 0C-75C
- Analysis Computer
 - ASAP 2020
 - Degas Ports
 - Analysis Port
- Temperature Control Bath
 - Analysis Gases



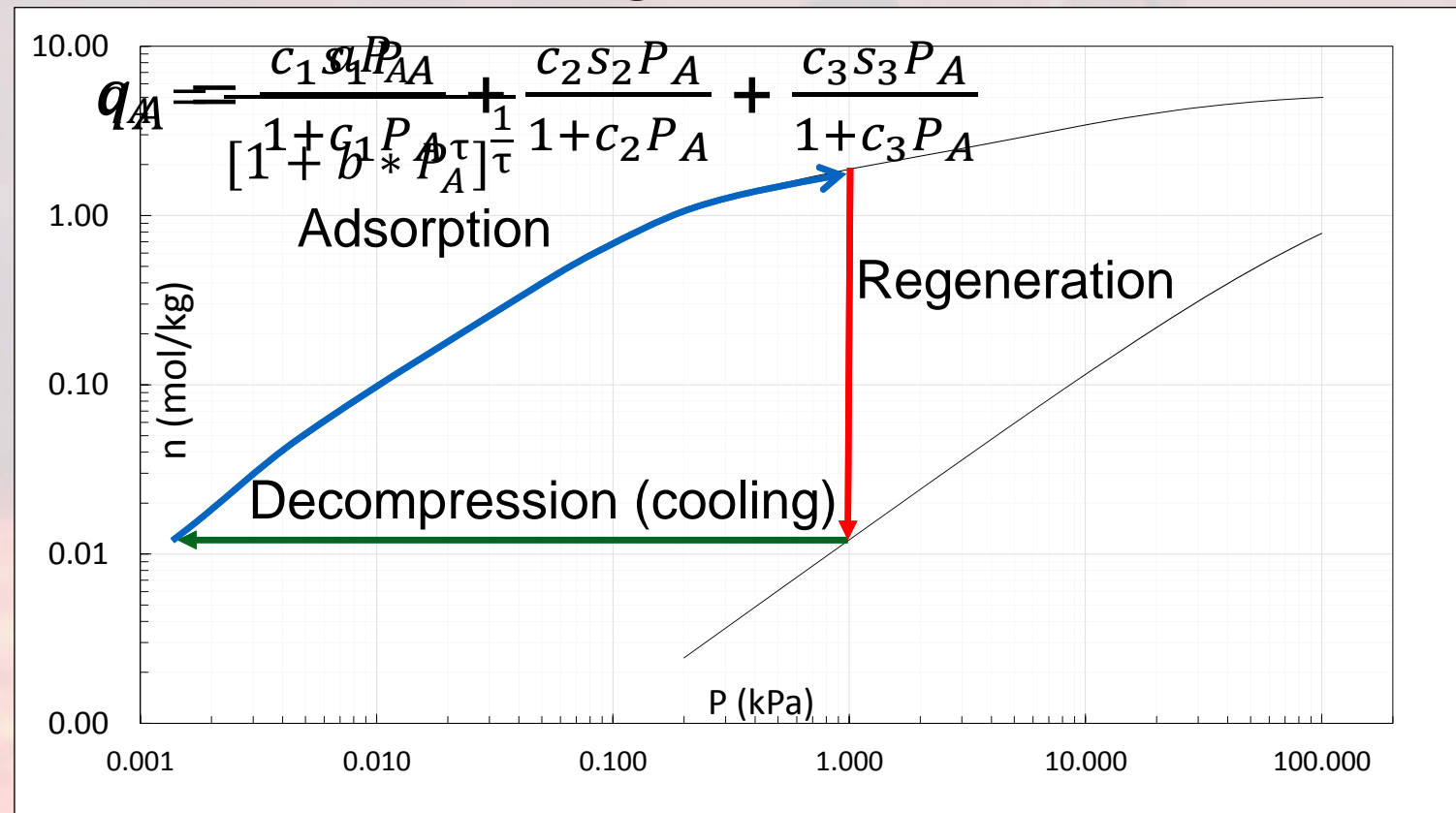
Analysis Method

- ASAP 2020 software package
 - Sample preparation
 - Free space measurement
 - P_0 and analysis temperature definition
 - Dosing method
 - Equilibration parameters



Sorbent Characterization through Empirical Modeling

- Isotherms
- Toth Model
- Langmuir 3-site Model

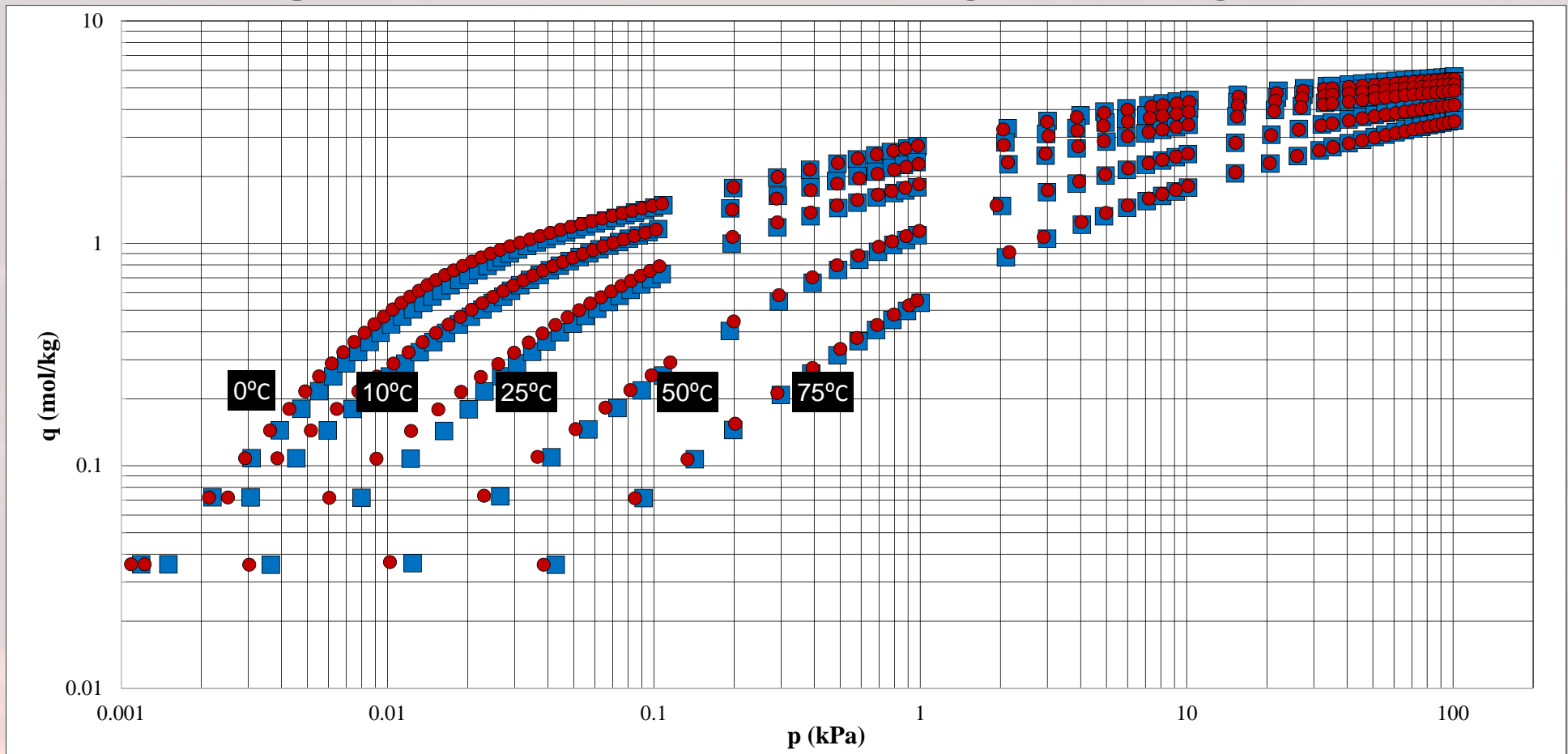


Sorbents of Interest

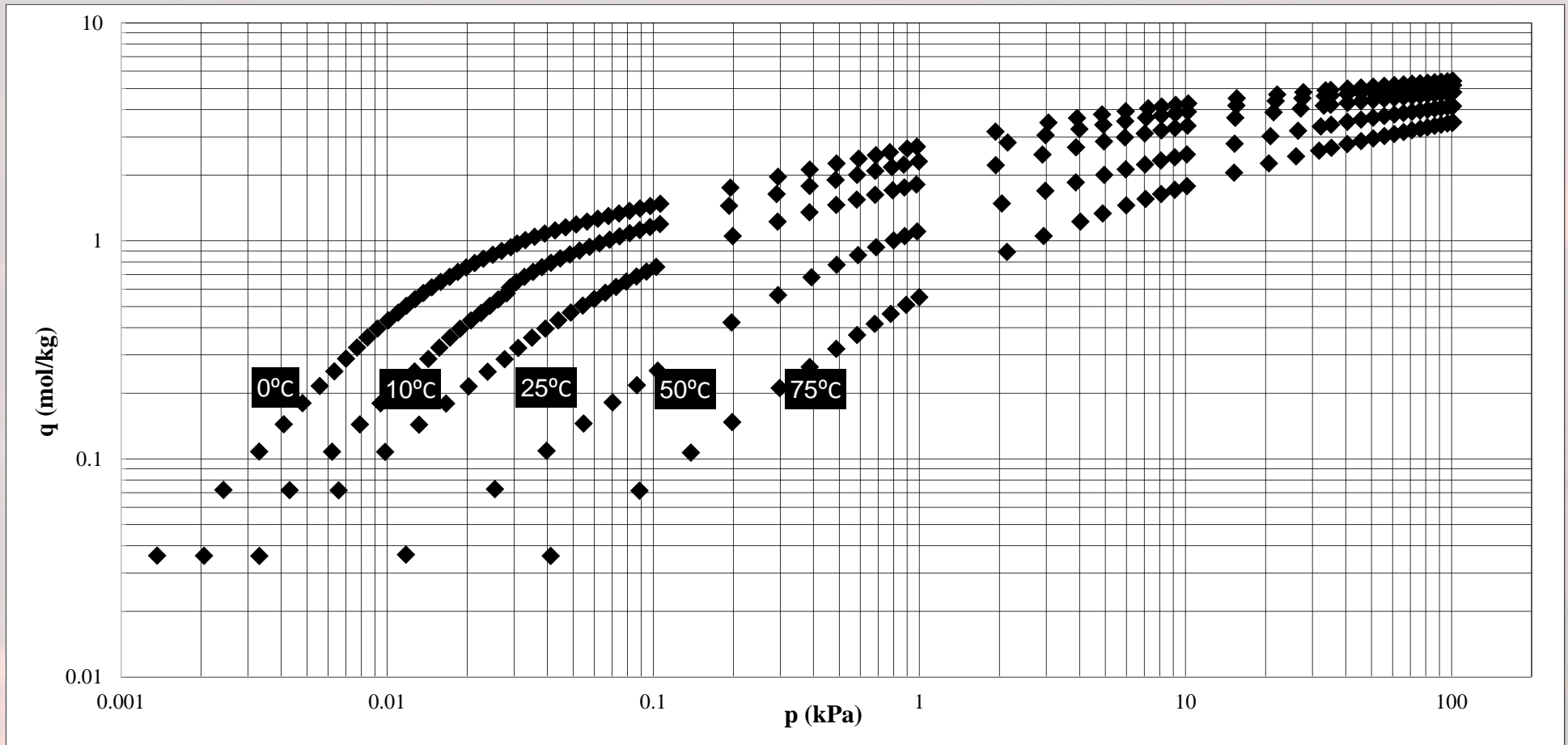
Name	Manufacturer	Form Factor	Type
Grade 544 13X	Grace Davison	Bead	Zeolite
BASF 13X	BASF	Bead	Zeolite
Grade 522 5A	Grace Davison	Bead	Zeolite
Grade 514 4A	Grace Davison	Bead </td <td>Zeolite</td>	Zeolite
APG-III	Honeywell UOP	Bead	Zeolite
VSA-10	Honeywell UOP	Bead	LiLSX



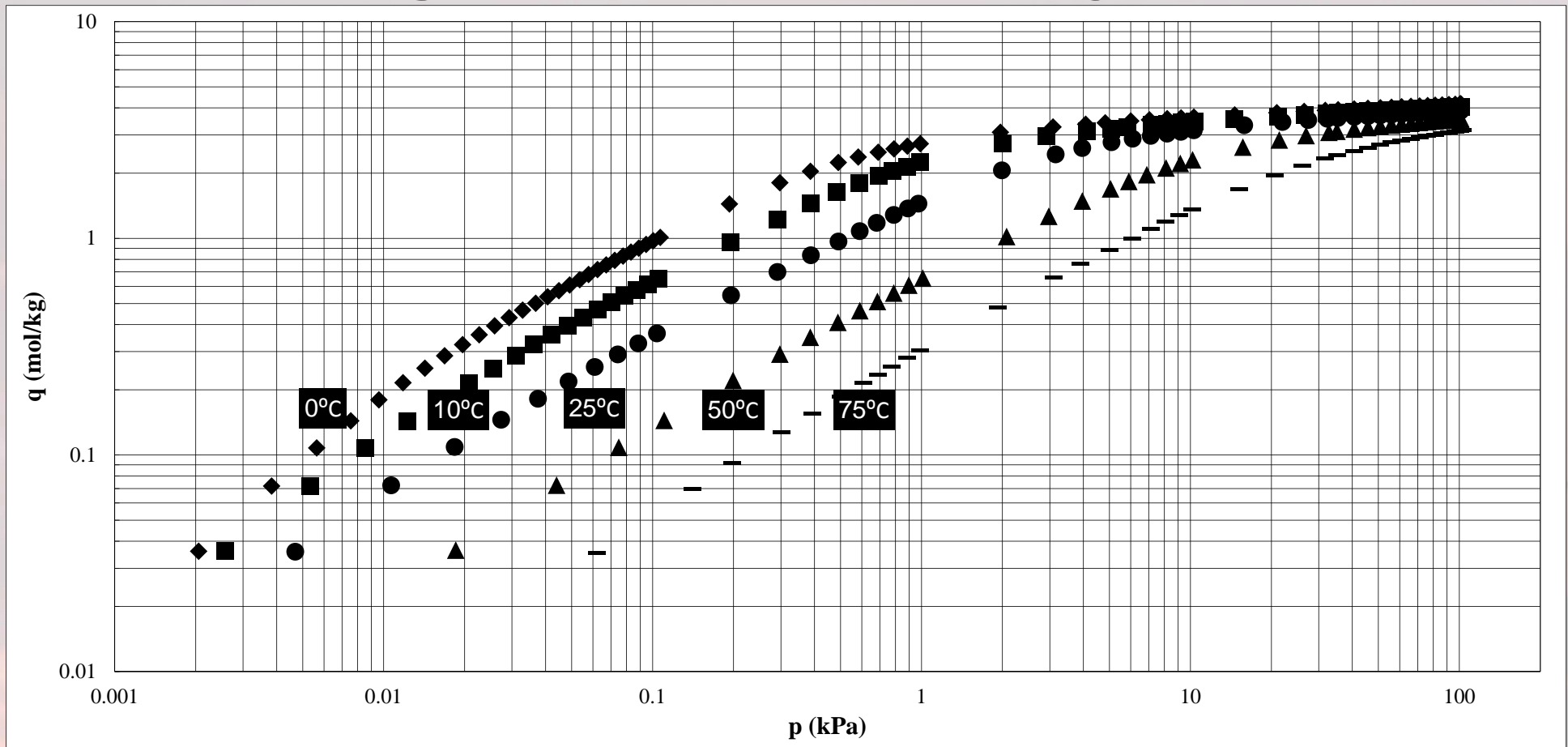
Grace Davison 544 13X



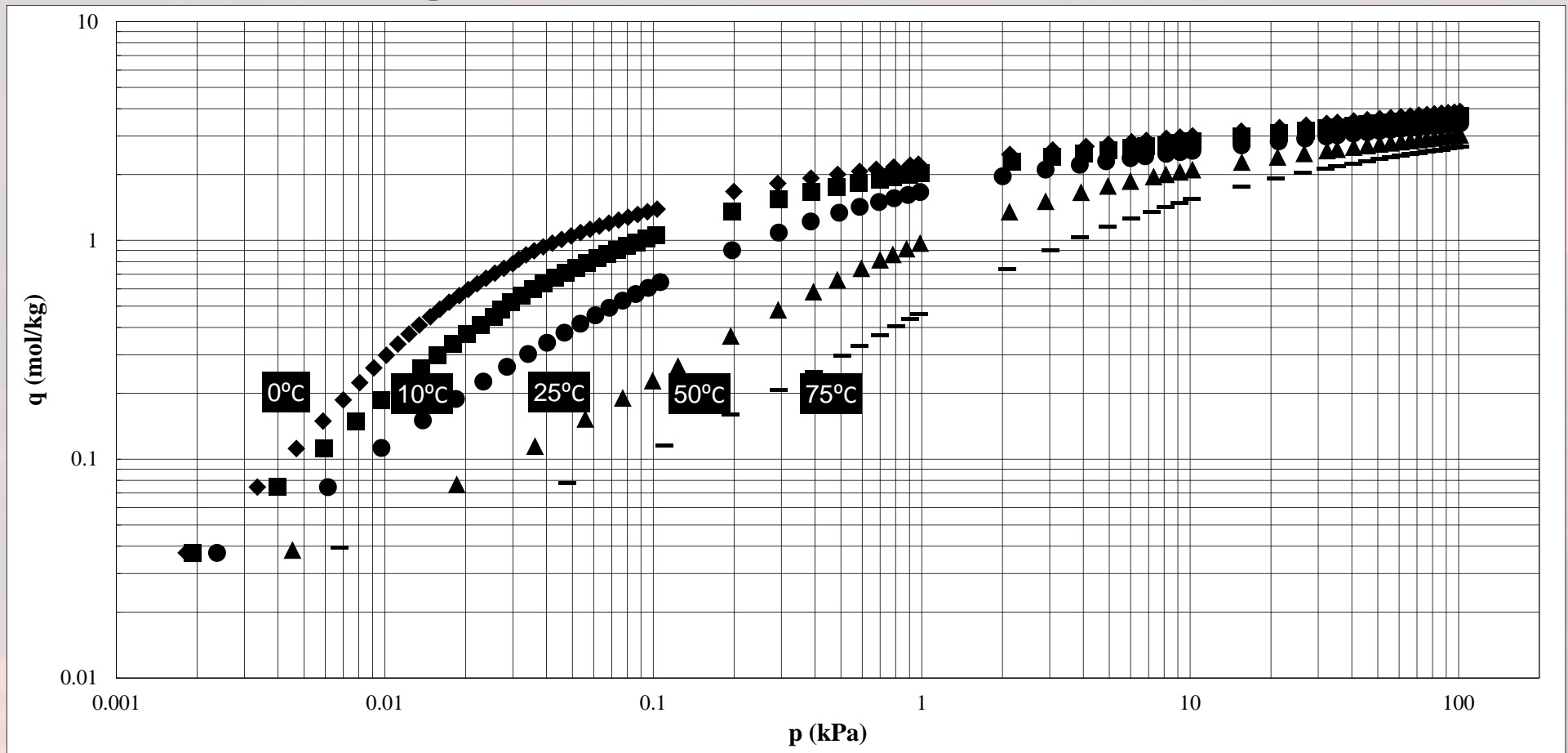
BASF 13X



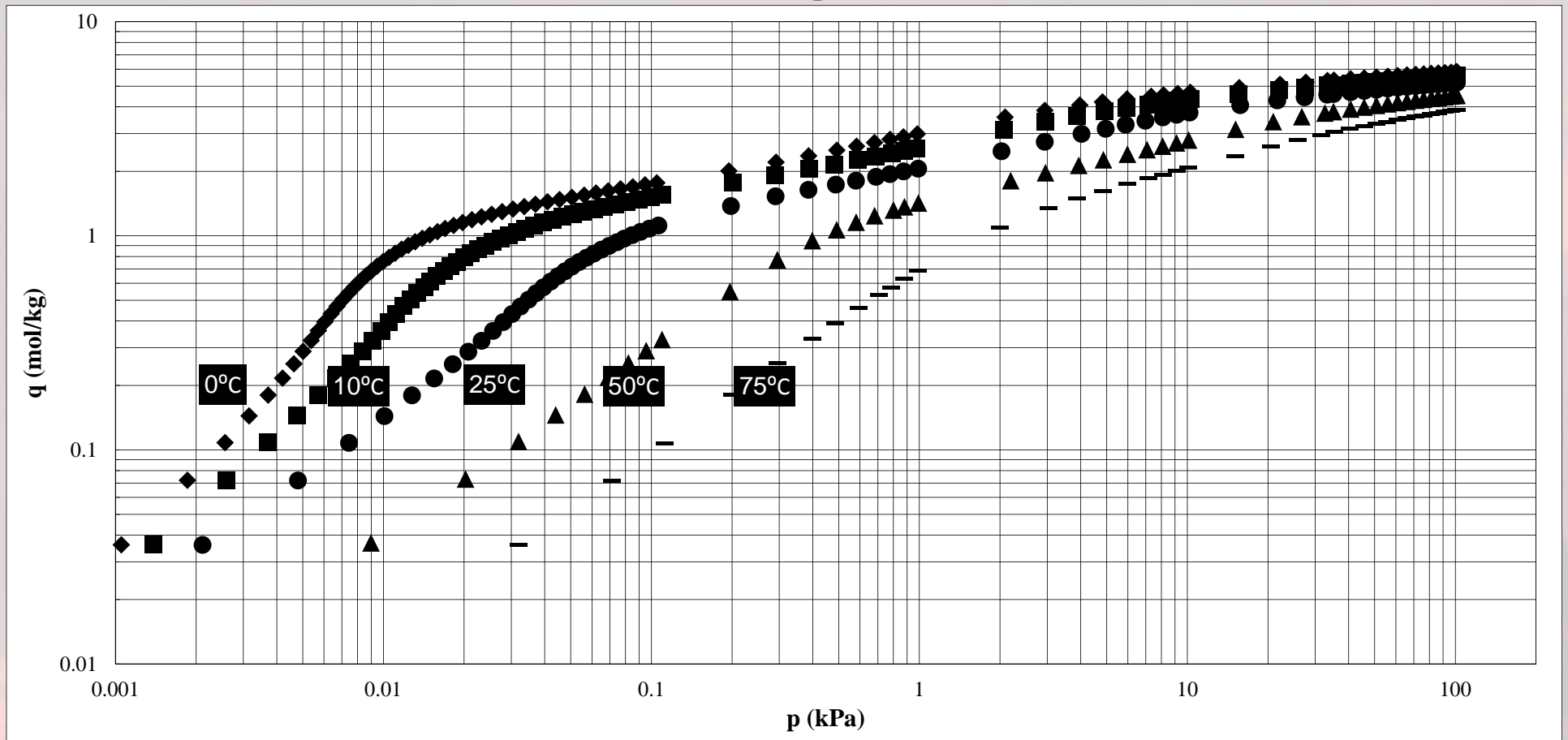
Grace Davison 5A



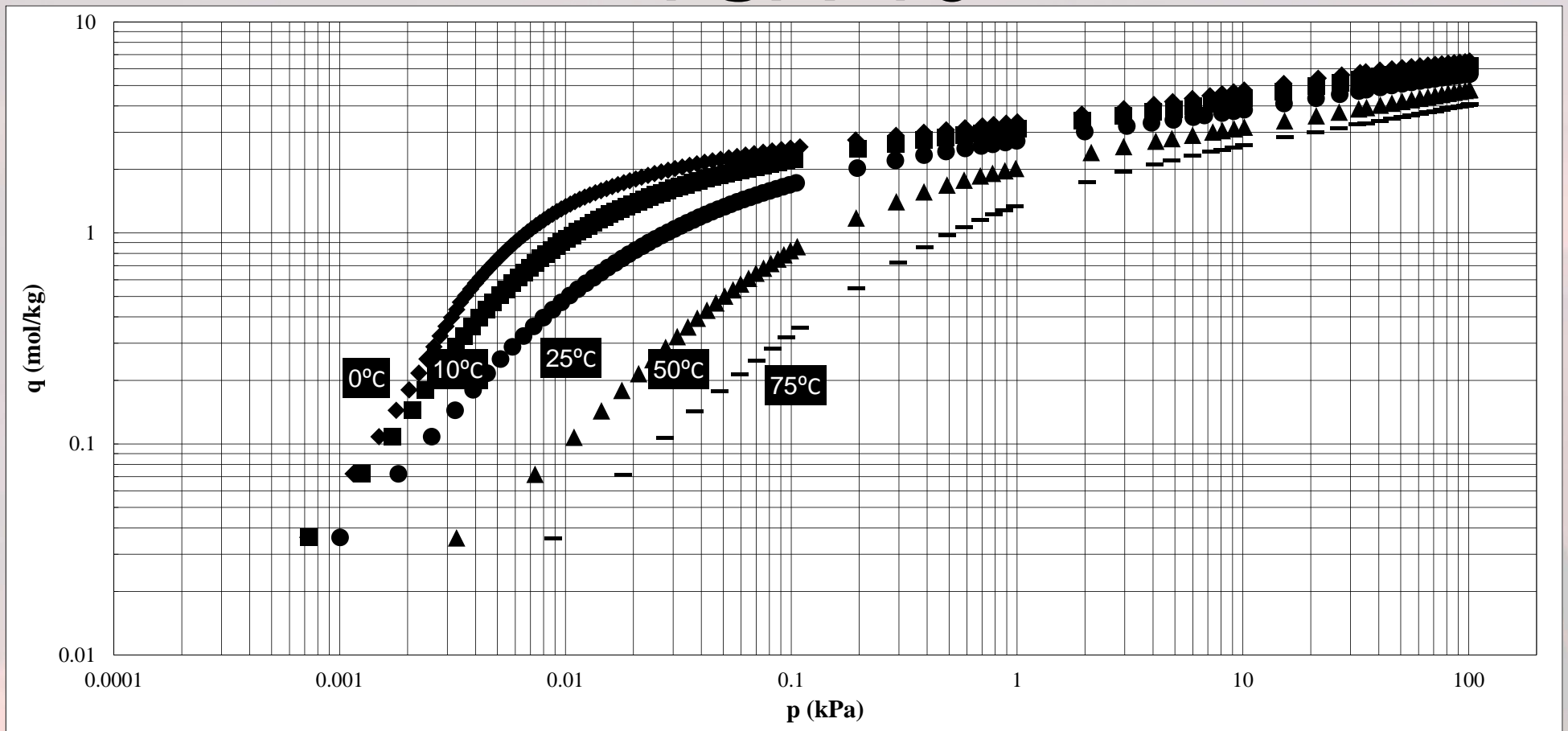
Grace Davison 4A



APG III

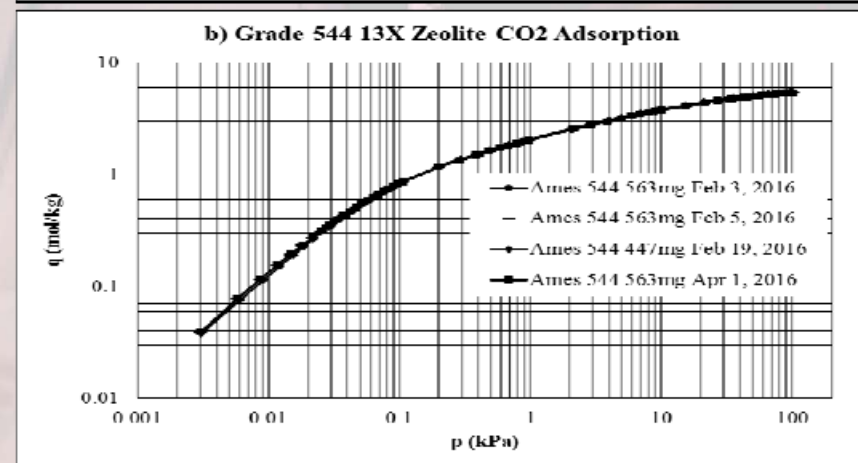
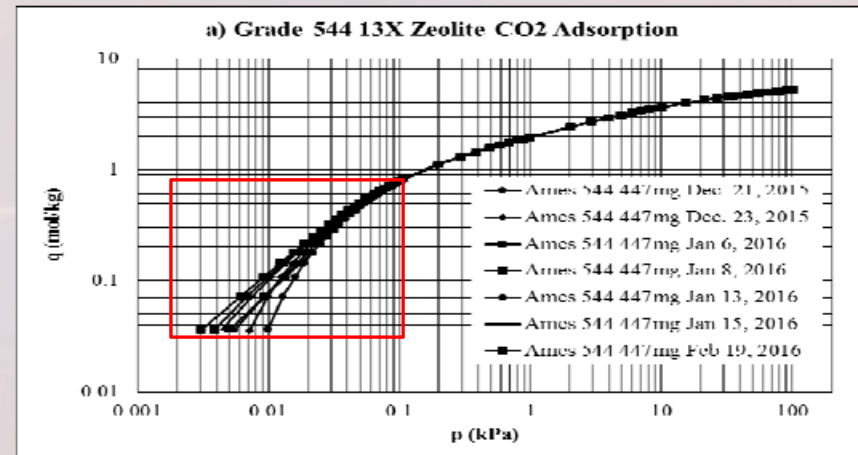


VSA-10



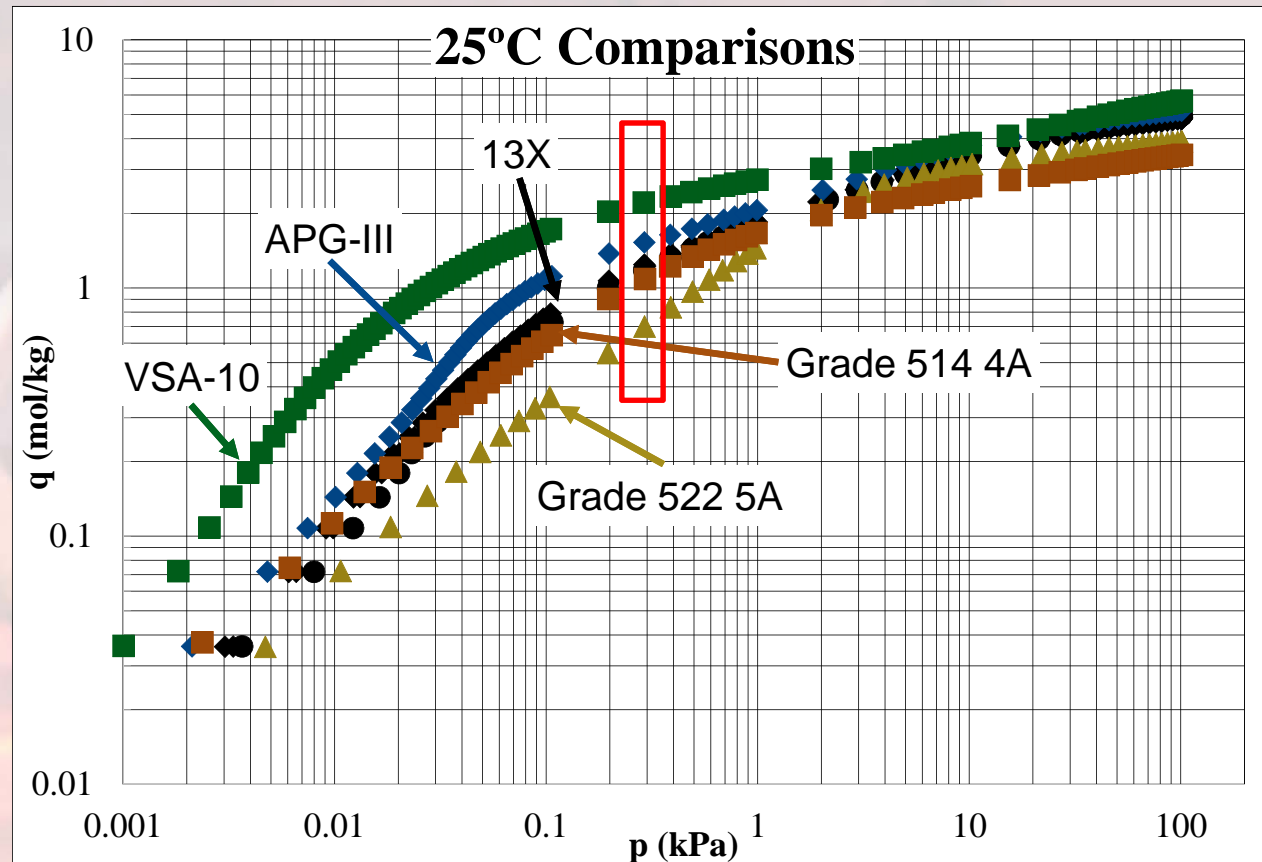
Procedural Lessons Learned

- Issues observed
- Data deviation at low pressures with analysis of the same sample
- Sorbent activation performed on Analysis Port rather than designated Degas Ports



Conclusions

- Tailored sample analysis parameters
- Current settings best for 13X, 5A
- LiLSX VSA-10 and APG-III materials show better CO₂ sorption capacity
- Datasets produce reasonable basis for system modelling



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