Structure of ice surface: evidence for the existence of amorphous and non microporous ice

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**Problem**
- Measurement of high specific surface area (A)
- Measurement of low heat of adsorption (∆Q): anomalously low if there is a pore confinement effect
- Does large specific surface prove microporosity?
  - Re-investigation of adsorption isotherm studies:
    - Comparison of amorphous (Ia) and crystalline (Ic) ices
    - Comparison of various adsorbates
    - Use of infrared co-measurements to check modifications in ice structure

**Experimental conditions**

**Ice formation**
- H₂O:Ar (1:30) gas mixture sprayed into the cell at 40 K
- Sample slowly annealed (0.2 K min⁻¹) to 90 K at which ice is expected to be amorphous

**Adsorbates**

<table>
<thead>
<tr>
<th>Adsorbates</th>
<th>N₂</th>
<th>CO</th>
<th>CH₄</th>
<th>Ar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size (Å)</td>
<td>3.4</td>
<td>3.7</td>
<td>4.2</td>
<td>3.8</td>
</tr>
</tbody>
</table>

**Ice sample characterization**

- IR spectrum typical of that of amorphous ice
- Type II isotherms in agreement with other studies
  - Similar values of A: 100-300 m².g⁻¹
  - Similar values of ∆Q: 2.5 kJ.mol⁻¹
- Analogous physical properties for our samples and for those obtained directly by water vapor deposition

**Ice sample annealing**

- T>110 K: decrease in A and νdH
  - Surface re-arrangement before crystallization
- T>150 K: A(Ic) = 15 % A(Ia)
  - no more νdH signal
  - Less dH bonds for Ic than for Ia

**Conclusions**

- N₂ is not suitable to probe porosity
- Evidence for the existence of amorphous and non microporous ice
  - Model of grain assembly (size < 65nm)?
- Open surface favours molecular mobility, diffusion and reactions
  - Importance for the understanding of interstellar reaction mechanisms?