

Ultra-stable cryo-electron microscopy holder

Background

One important technical problem in cryo-electron microscopy (cryo-EM), when trying to attain atomically resolved 3D structures of frozen hydrated specimens, is the negative effect on the resolution due to the vibration from liquid nitrogen cooling. Sample holders for cryo-EM have so far relied on the use of a Dewar with liquid nitrogen to cool down sample to temperatures below -170°C . The use of liquid nitrogen is often inconvenient and difficult to implement. Water crystallization inside the Dewar and relative hot spots may induce vibration through bubbling, limiting the attainable spatial resolution. Significant user expertise is required under such adverse conditions to perform single particle cryo-EM experiments and successfully achieve atomic spatial resolution (below 0.3 nm). There is thus a need for cryo-EM design that is stable (minimal to no vibration) and can provide prolonged cooling periods, hence longer viewing times.

Description of the invention

Waterloo researchers have designed a cryo-EM holder that does not require the use of liquid nitrogen and thus avoids the constant refilling step inherent with this method. The novel Waterloo holder utilizes a Joule-Thomson cell to deliver quasi-vibration free cooling. This design is capable of providing similar sample temperatures and cooling power as the liquid nitrogen cooling method, but with the benefit of no vibration and extended (basically unlimited) cooling periods.

Advantages

This technology enables cryo-EM with greater resolution and extended cooling for longer viewing periods. In addition to being easy to use, this cryo-EM holder eliminates mechanical noise that enables previously unattainable conditions under which frozen hydrated specimens may be studied.

Potential applications

- Atomically resolved structural determination
- Single particle cryo-EM and cryo-ET (electron tomography)
- Pharmaceutical R&D

Reference

10139

Patent status

PCT/CA2019/051251
& CA and US patents

Stage of development

Prototype to be built soon
Ongoing research

Contact

Scott Inwood
Director of Commercialization
Waterloo Commercialization Office
519-888-4567, ext. 43728
sinwood@uwaterloo.ca
uwaterloo.ca/research