

(Feb. 27, 2012) □ Researchers of VTT Technical Research Centre of Finland have shown that surface tension on a solid material is unconnected to the energy required to create a new surface. Consequently, surface tension on a solid does not exist in its conventional meaning.

It is generally believed that an excess surface tension on a solid material exists, in similar manner to that on a liquid. This tension is described by the Shuttleworth equation, which was presented more than 60 years ago and is considered a fundamental equation of surface thermodynamics. It is believed to provide the connection between surface tension and surface energy.

Three years ago, VTT researchers Lasse Makkonen and Kari Kolari, together with British scientist David Bottomley, revealed in the Surface Science journal that the Shuttleworth equation is incompatible with the thermodynamic theory. This was hard to accept by many and provoked a lively discussion in the scientific literature.

Now Lasse Makkonen has shown mathematically that the disputed equation reduces to the definition of mechanical surface stress and has no connection with the energy of creating a new, unstrained surface. Consequently, the excess surface tension suggested by the Shuttleworth equation does not exist. The existence and nature of surface tension on a solid must therefore be sought by molecular dynamics at the surface layer only.

---

### Story Source:

The above story is [reprinted](#) from [materials](#) provided by [Technical Research Centre of Finland \(VTT\)](#), via [AlphaGalileo](#).

## 60-year-old definition of surface tension on solids revised

Written by Editor

Monday, 27 February 2012 11:12

---

*Note: Materials may be edited for content and length. For further information, please contact the source cited above.*

---

### Journal Reference:

1. Lasse Makkonen. **Misinterpretation of the Shuttleworth equation.** *Scripta Materialia*, 2012; DOI:

[10.1016/j.scriptamat.2012.01.055](https://doi.org/10.1016/j.scriptamat.2012.01.055)

*Note: If no author is given, the source is cited instead.*

**Disclaimer:** *Views expressed in this article do not necessarily reflect those of or its staff.*