

DIATOME

ultra sonic

Thinner sections
No compression
Better structural preservation

Patented





The oscillating diamond knife, exclusively from Diatome!

For many years Diatome diamond knives have been used successfully for a wide range of room- and low temperature sectioning applications.

Major advances in immunocytochemistry, the sectioning of frozen hydrated specimens, semithin sectioning for optical microscopy, as well as the sectioning of hard industrial samples have been realised using Diatome diamond knives (refs. 1, 2, 3, 4, 5).

The development of the Static Line II ionizer enabled dry ultramicrotomy of Lowicryls (ref. 6) and a considerable improvement in cryosectioning (ref. 2).

Despite these innovations, until now, one major obstacle remained, preventing us from achieving perfect ultrathin sections: «compression» (we define compression as the shortening of the section compared to the sample height).

The amount of compression depends on various factors including:

- The wedge angle of the knife
- The hardness of the sample
- The interaction diamond surface / section surface (when sectioning dry)
- The section thickness.

The most critical factor is the wedge angle of the knife. It was shown that reducing the wedge angle results in a reduction of compression, hence better preservation of ultrastructure which allows a higher achievable resolution (refs. 7, 8).

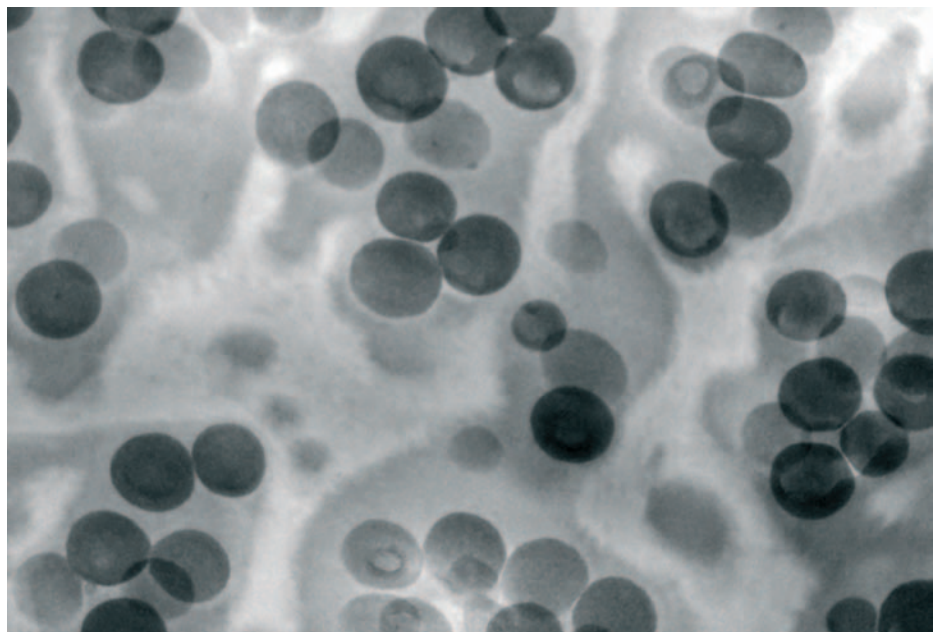
However, the wedge angle may not be reduced ad infinitum. A further reduction results in a lower cutting edge quality and a considerably shorter life span.

In room temperature ultramicrotomy, we have found the following compression factors (section thickness 50nm):

- 10-20% for Epon, Araldite, EM-Bed, and other epoxy resins
- 12-24% for Lowicryl K4M
- 10-17% for Spurr's (hard grade)
- 8-13% for LR White (hard grade).

These limitations have stimulated our efforts to develop the oscillating knife.

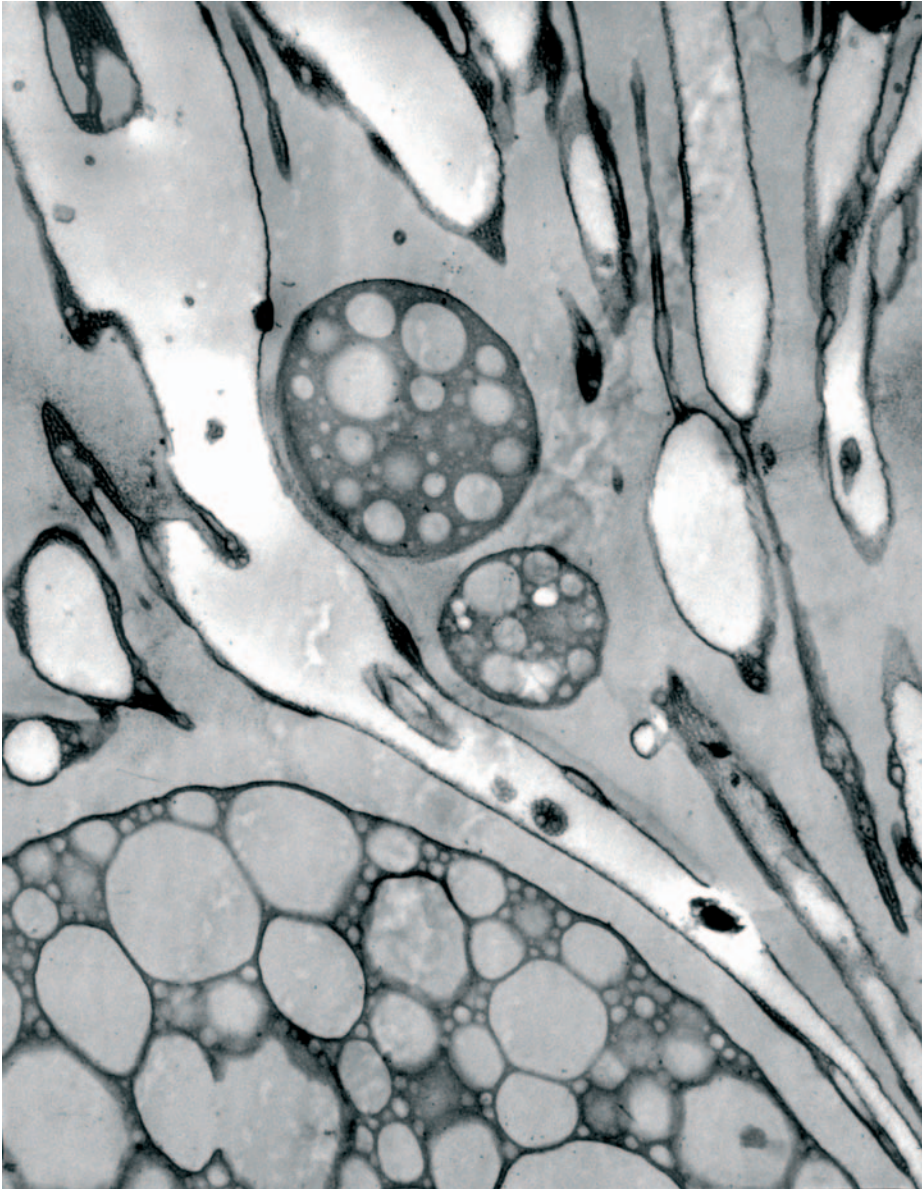
Here we proudly introduce the Diatome ultra sonic, the oscillating diamond knife for room temperature ultramicrotomy. It was developed in collaboration with Dr Daniel Studer, Lab. of Anatomy, University of Berne.



◀◀
Neuropil of a HP frozen / freeze substituted hippocampus slice culture
Daniel Studer and Werner Graber, Inst. of Anatomy, University of Bern
————— 200 nm

▲
Polycarbonate modified with rubber
Jens Sicking, Bayer Technology Services, Leverkusen

ultra sonic



▲
High Impact Polystyrene / Polypropylene blend
Bob Vastenhout, Dow Chemicals, Terneuzen

A piezo actuator produces an oscillation of the knife at a desired frequency and amplitude, parallel with the cutting edge. A depression in the foot of the knife allows the oscillation parallel to the cutting edge. The depression is rigid in the north/south direction and guarantees stability in the cutting direction.

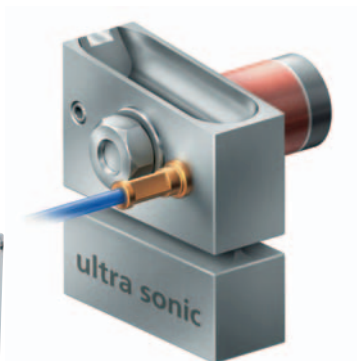
The ultra sonic knife produces ultrathin sections almost free of compression. The sections become thinner at the same thickness setting: since the volume of the section remains the same, the increased length leads to a decrease in thickness.

The theoretical considerations and first results of this invention were presented in the Journal of Microscopy (ref. 9).

Results with polymers using the oscillating knife were shown at the M&M 2002 meeting in Quebec (ref. 10) and in Microscopy Today (ref. 11).

We have tested the oscillating knife with the following samples:

- Biological samples in Epon, Araldite, EM Bed, etc.
- Biological samples in acrylic resins (Lowicryls, LR White)
- Rigid polymers such as PS, PMMA, ABS, HIPS, modified PP, etc.



Specifications

Knife

Knife angle:	35°
Cutting range:	10-100nm
Cutting edge length:	3.0mm

Control unit

Frequency:	20-45kHz, or automatic setting of the resonance
Amplitude:	variable (Voltage 0-30V)
Mains voltage:	230V, 110V

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