

XRD Study of NiTi Endodontic Files Using Synchrotron Radiation

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Overview

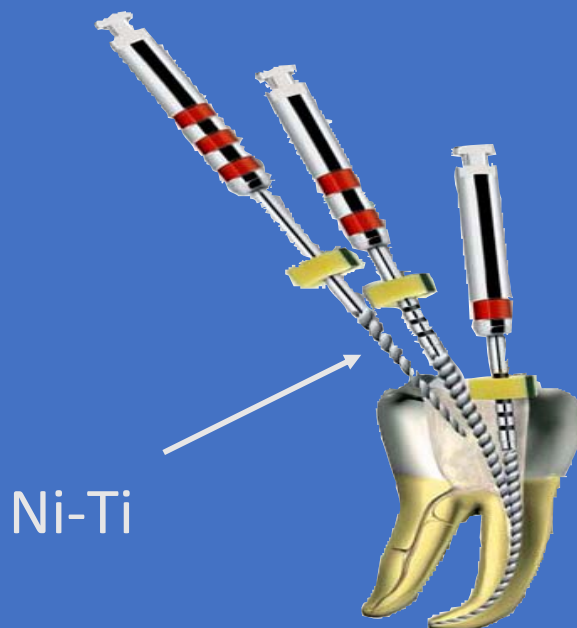
- Identification of the problem
- Identification of the possible solution
- Material issues: Superelasticity
- Material testing
- XRD analysis in flexion
- Stress-induced martensite
- Future work

The Problem



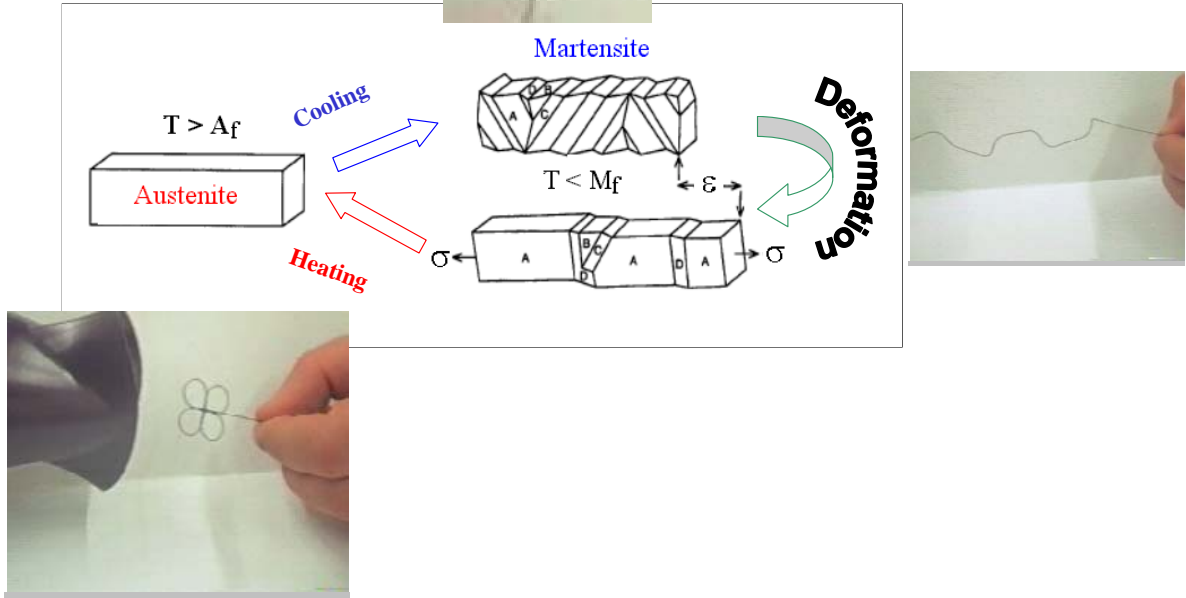
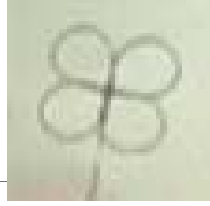
- Ni-Ti alloys - Superelasticity -

- Application: ENDODONTICS



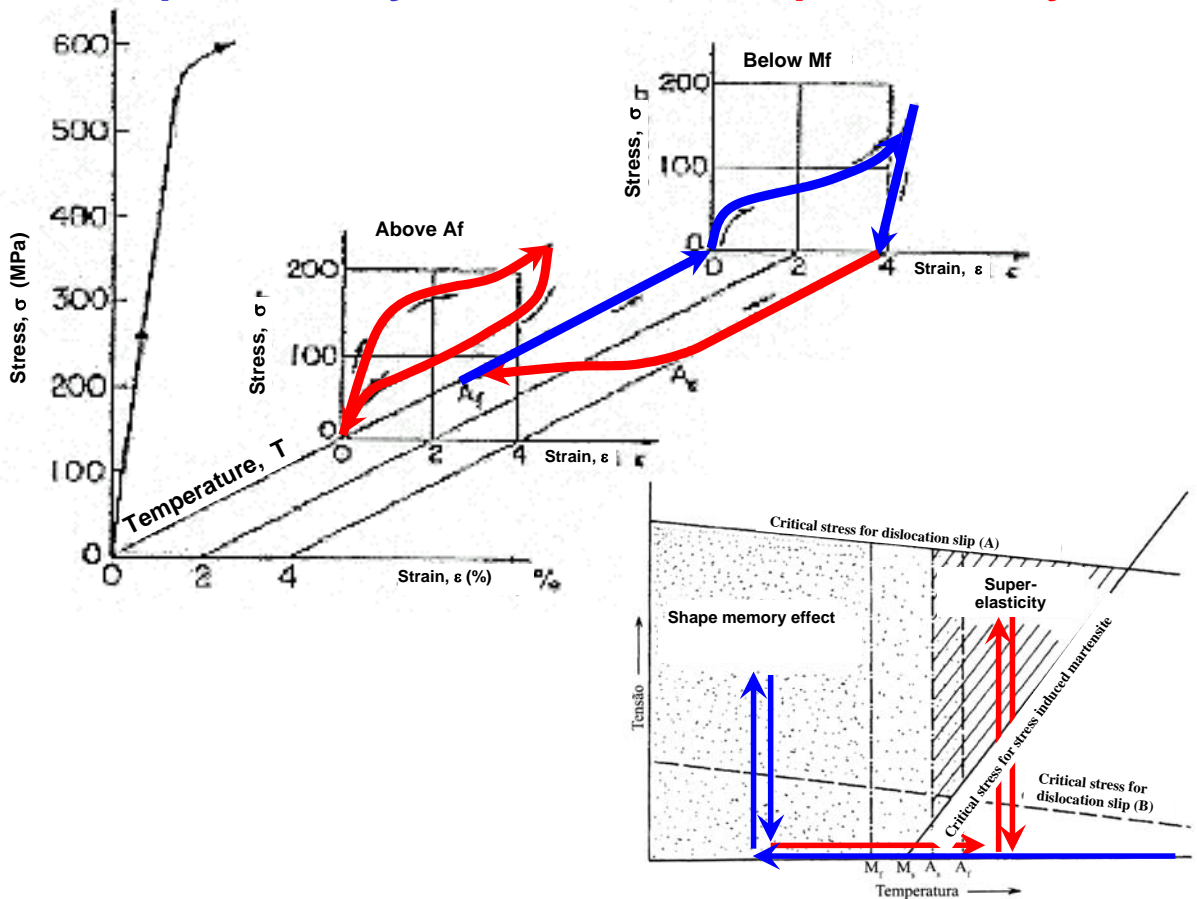
Fracture

Shape memory Effect

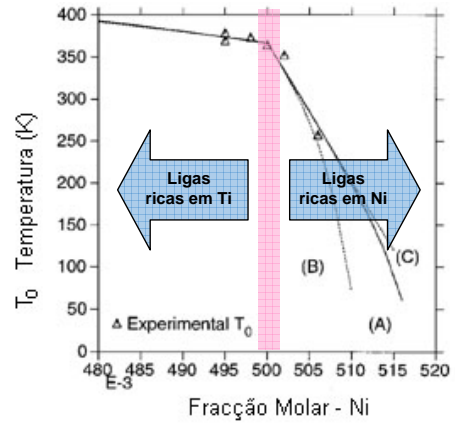
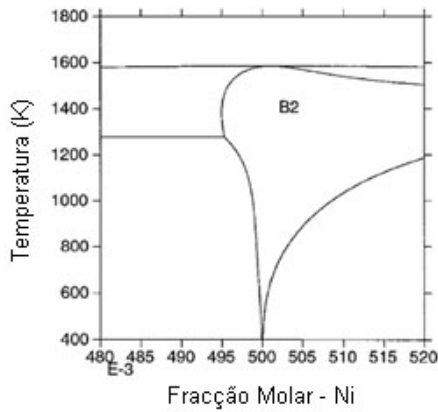
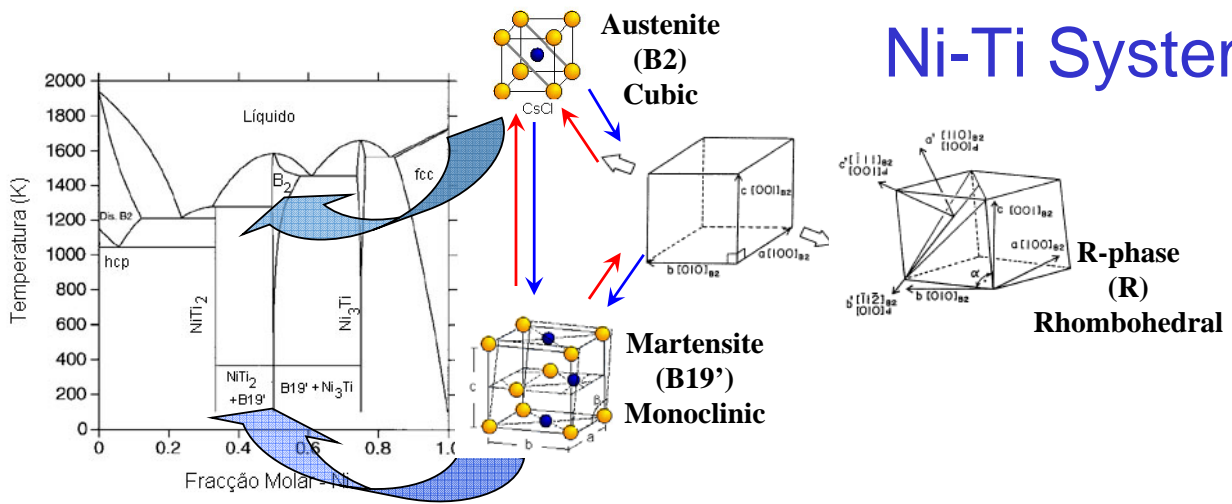


Shape memory effect

superelasticity

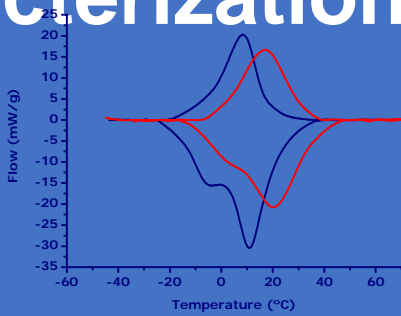


Ni-Ti System



W. Tang, B. Sundman, R. Sandström, C. Qiu. *Acta materialia* 47 (1999) 3457-3468

Endodontic files material characterization



Profile ® .06 (35)



10 samples

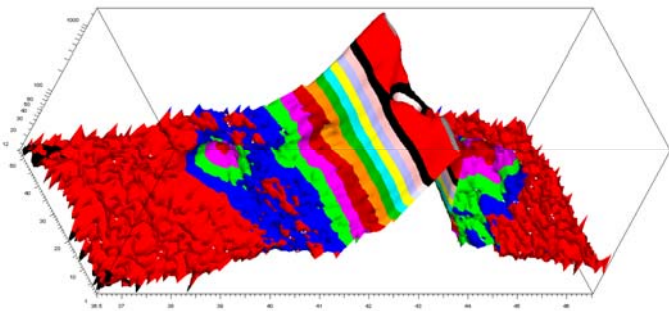
10 samples



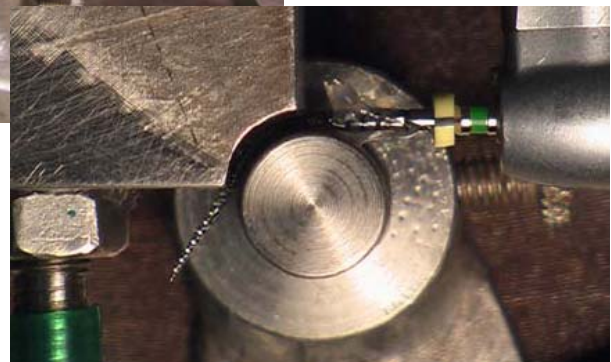
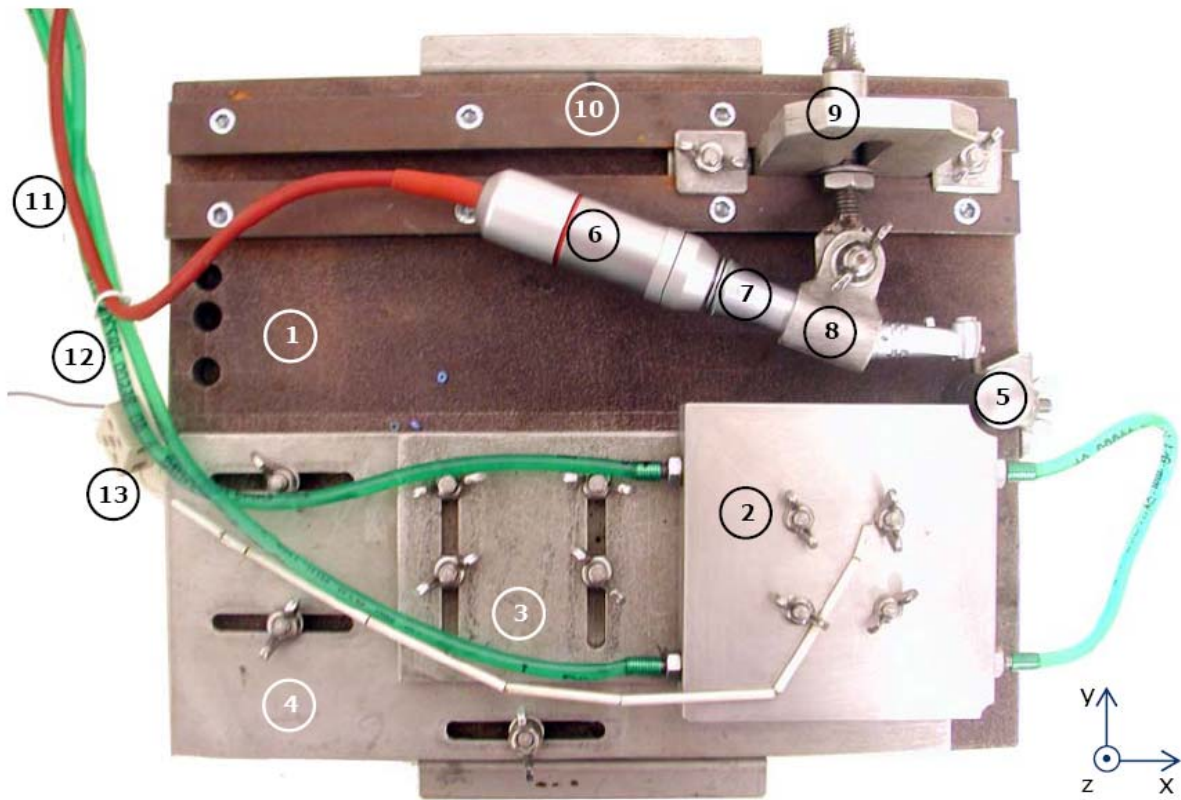
DSC

DSC

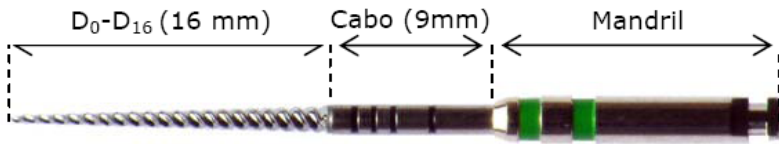
"Mechanism of NiTi file fracture based on rotation/flexion assays in three endodontic files". S. Vilaverde Correia, R. J. C. Silva, M.T. Nogueira, R. F. Martins, L. Pires Lopes, F.M. Braz Fernandes. *Actas de "11ª Jornadas Portuguesas de Fractura / 11th Portuguese Conference on Fracture"* (ISBN 978-989-95683-0-3), pp 383- 392, Caparica, 2008.



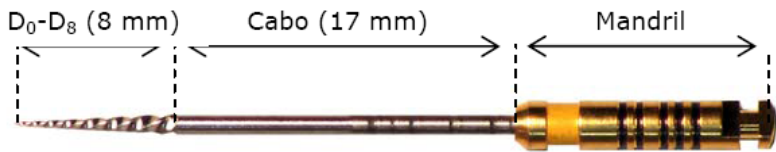
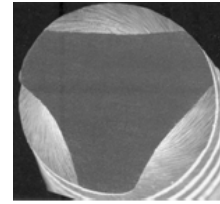
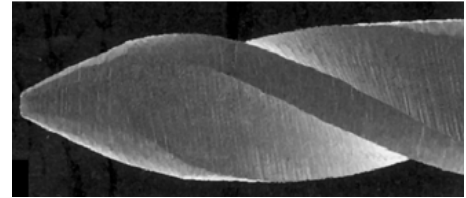
Testing – Rotation / Flexion



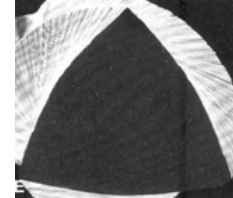
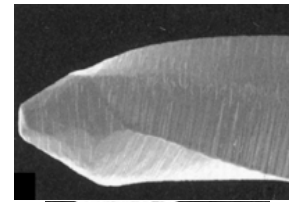
Testing Rotation / Flexion



Aspecto macroscópico: ProFile .06(35) de 25 mm.

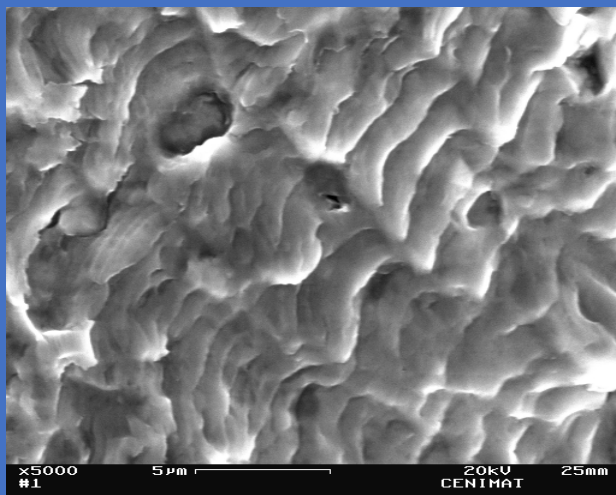
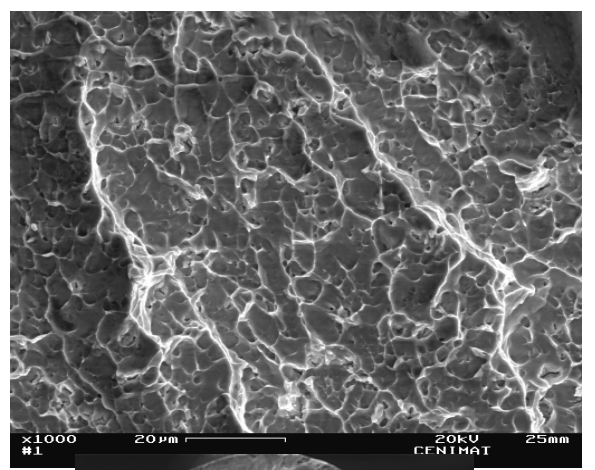
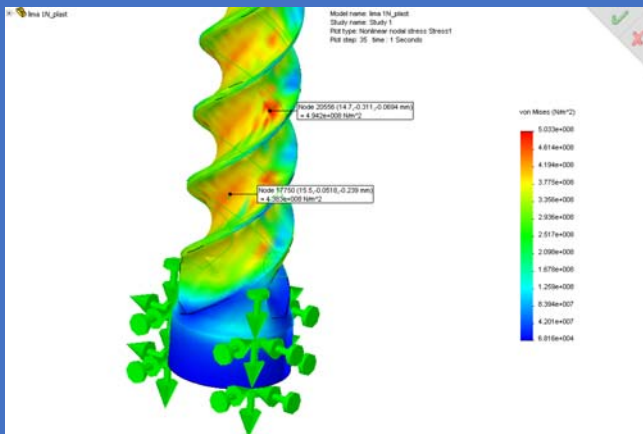


Aspecto macroscópico: ProFile GT .10(20) de 25 mm.



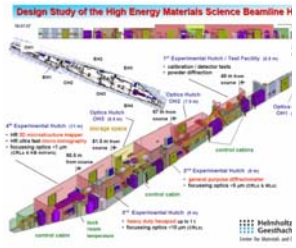
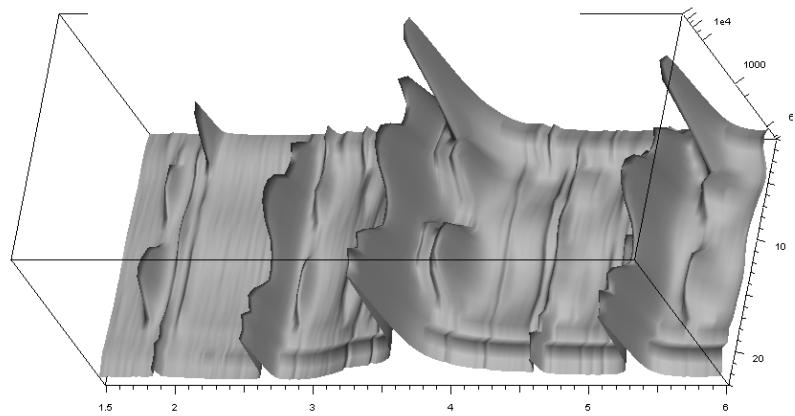
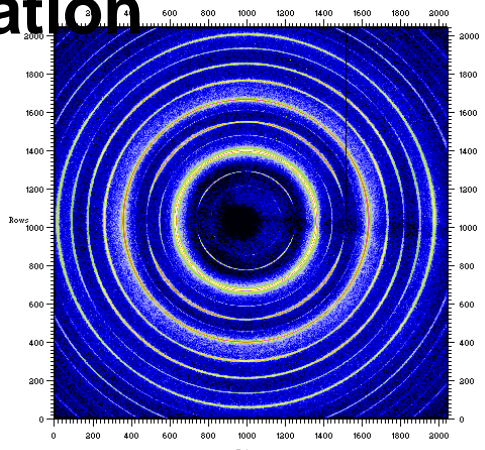
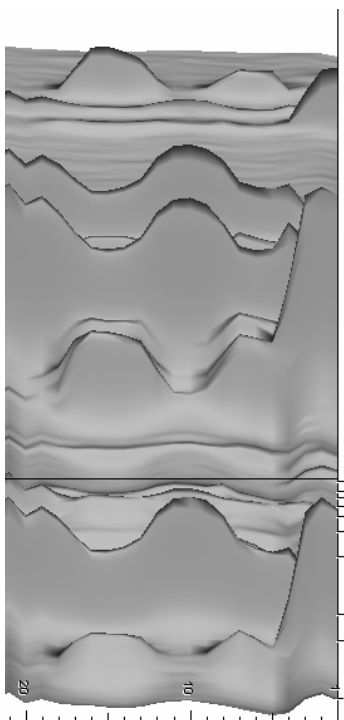
Aspecto macroscópico: ProTaper S1 de 25 mm.

Fracture of endodontic files



"Mechanism of NiTi file fracture based on rotation/flexion assays in three endodontic files". S. Vilaverde Correia, R. J. C. Silva, M.T. Nogueira, R. F. Martins, L. Pires Lopes, F.M. Braz Fernandes. Actas de "11ª Jornadas Portuguesas de Fractura / 11th Portuguese Conference on Fracture" (ISBN 978-989-95683-0-3), pp 383- 392, Caparica, 2008.

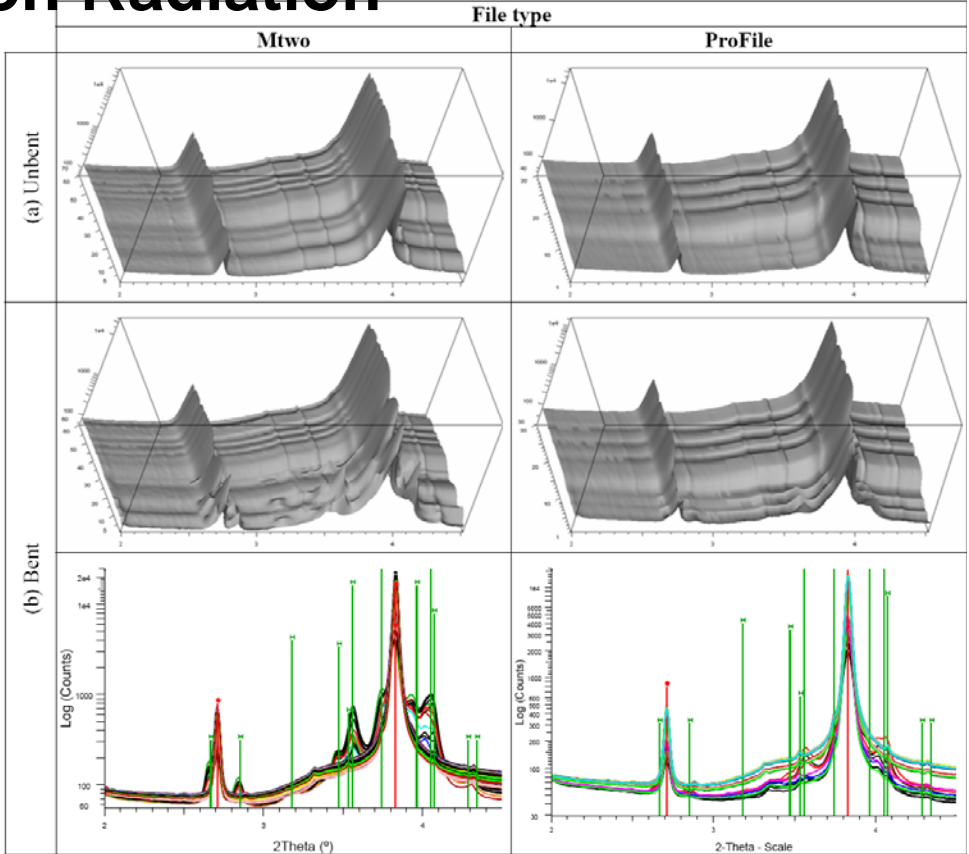
RD Study of NiTi Endodontic Files Using Synchrotron Radiation



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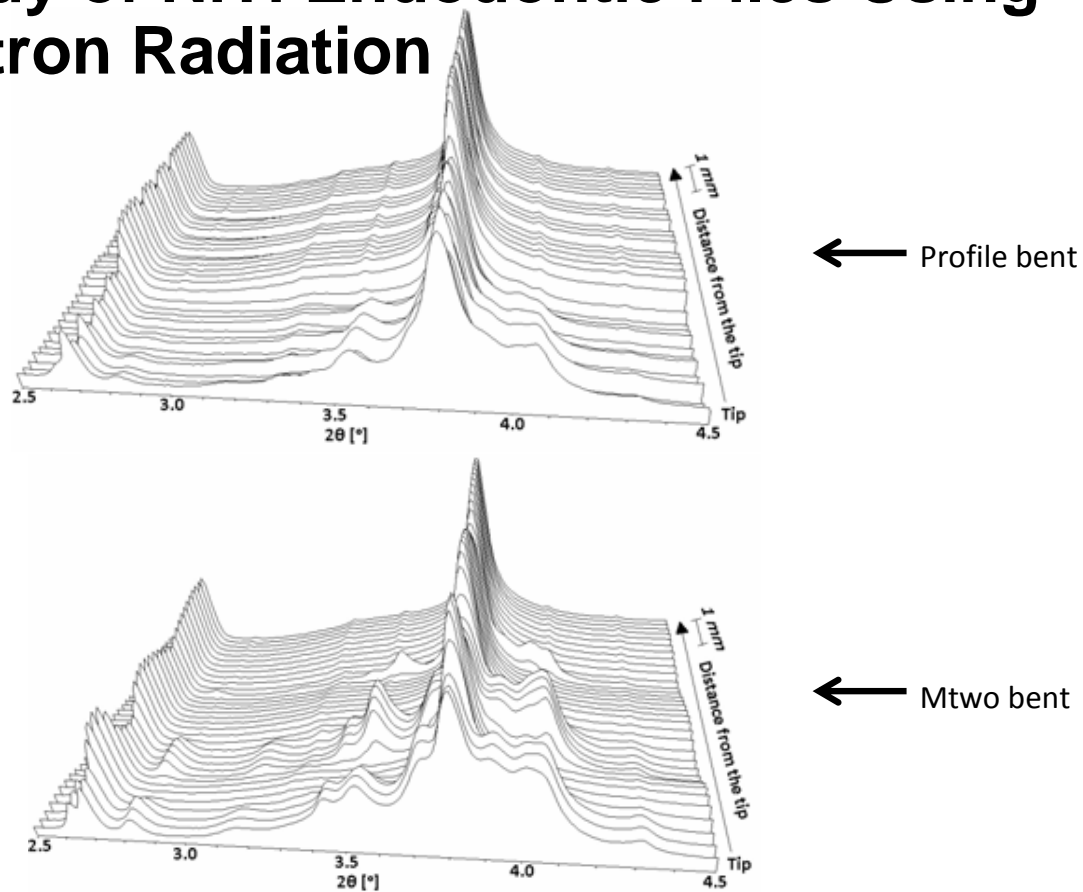


M-Two .04(35)

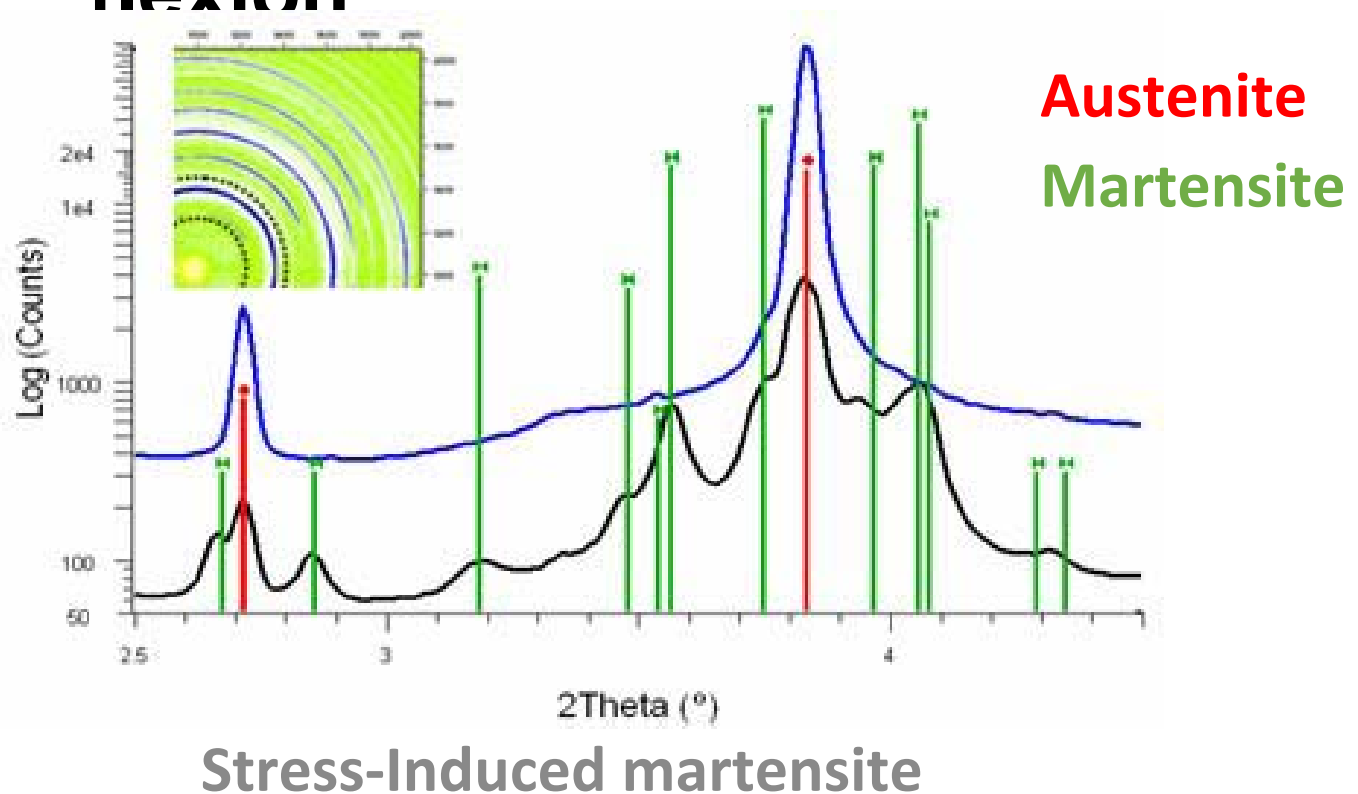


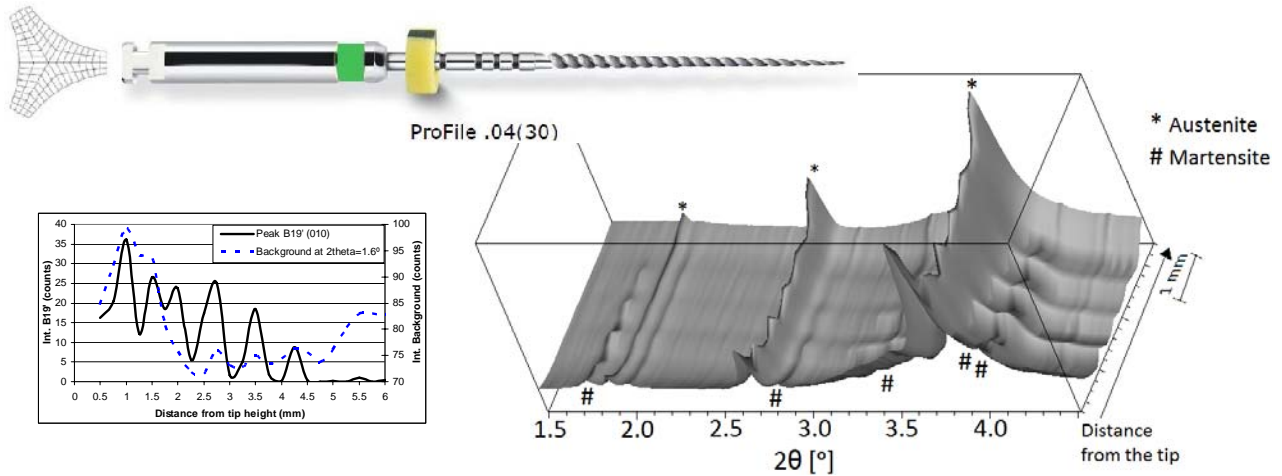
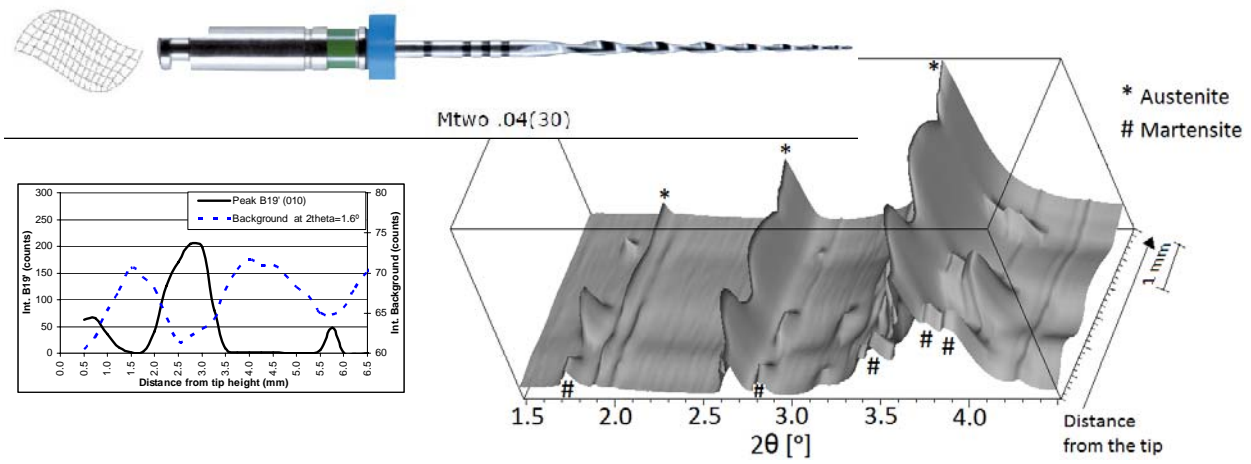
ProFile .04(35)

RD Study of NiTi Endodontic Files Using Synchrotron Radiation

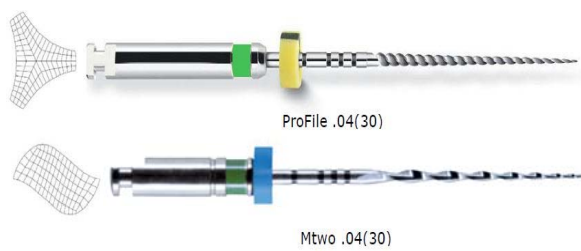


Endodontic files under flexion

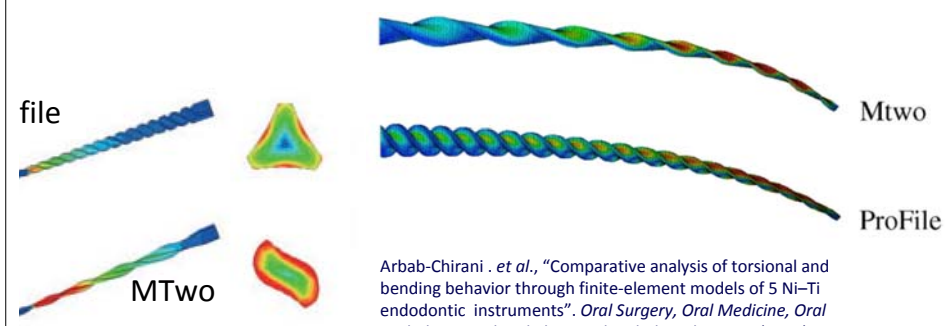
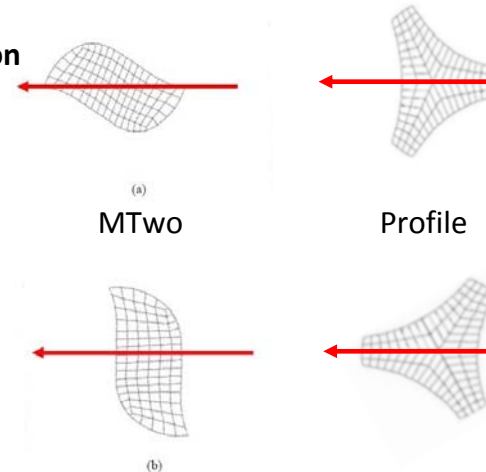




RD Study of NiTi Endodontic Files Using Synchrotron Radiation

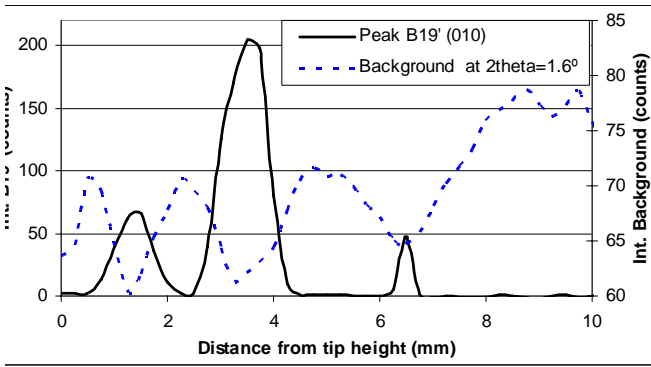


Maximum Absorption of X-rays

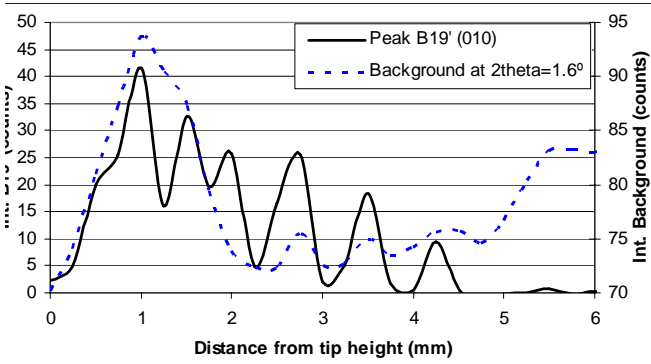


Arbab-Chirani . et al., "Comparative analysis of torsional and bending behavior through finite-element models of 5 Ni-Ti endodontic instruments". *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology and Endodontology* 111 (2011) 115-121.

CONCLUSION

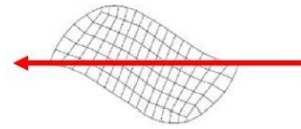


MTTwo



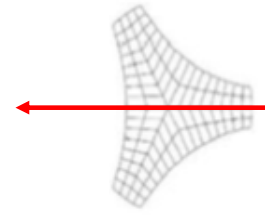
Profile

S

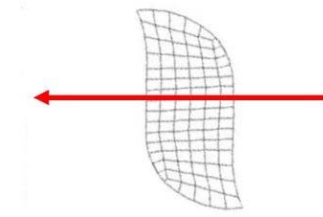


(a)

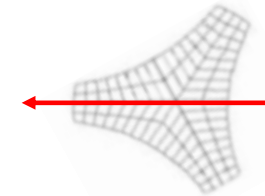
MTTwo



Profile



(b)



- Stress distribution in the cross-section and stress-induced martensite transformation is affected by **geometry**
- **Exact location of stress concentration has been experimentally identified**

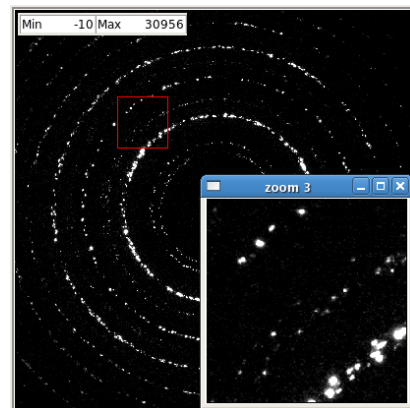
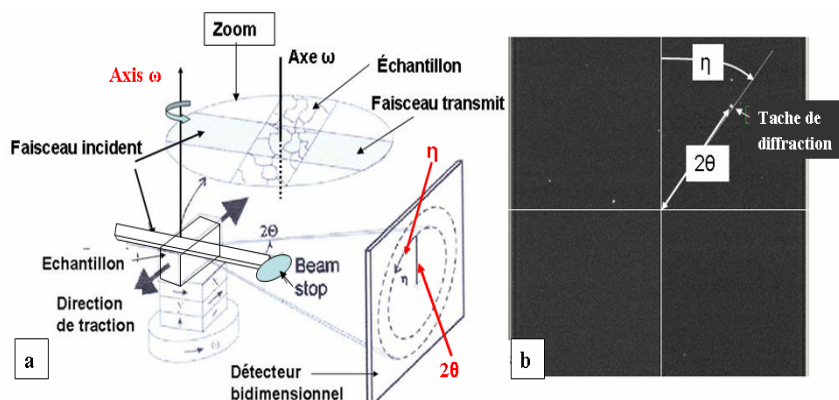
Future work



- Torsion tests



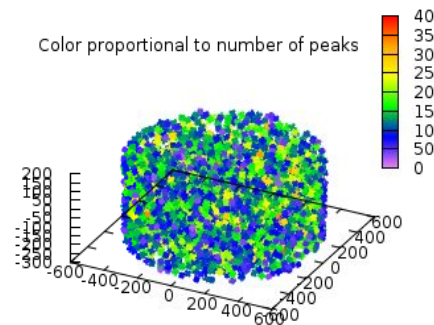
3DXRD



amélioration d'une méthodologie d'analyse des données après des expériences
in-situ de diffraction à haute énergie pour un Alliage à Mémoire de Forme à
grains micrométriques

liant stagiaire : Younes ELHACHI

adré par : Benoît Malard – CIRIMAT , INP, Toulouse



Thank you

for your attention!