



REDUCTION OF
RADIOLOGICAL
ACCIDENT
CONSEQUENCES



POLITECNICO
MILANO 1863



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SCIANTIX: Examples of validation databases on bubble evolution

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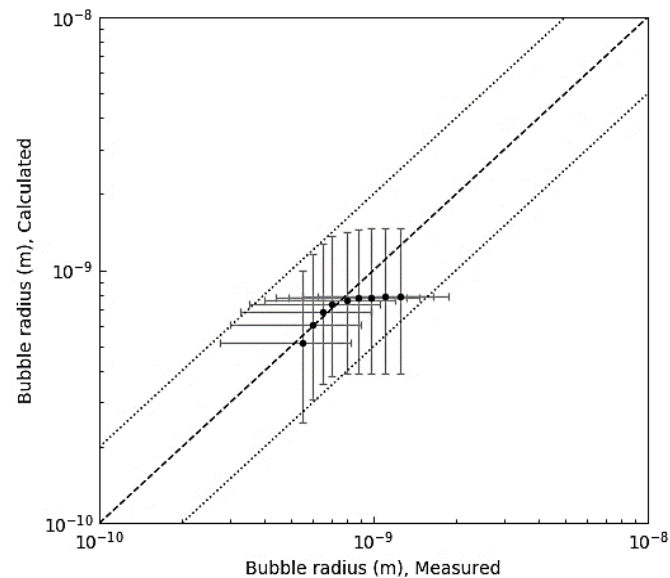
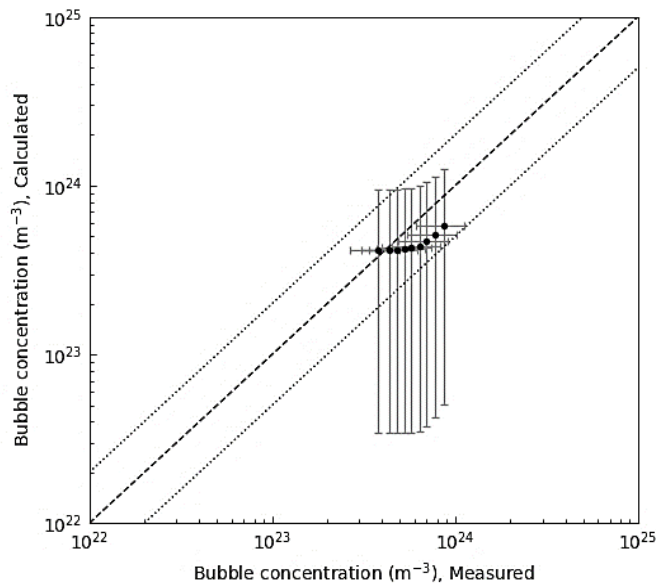
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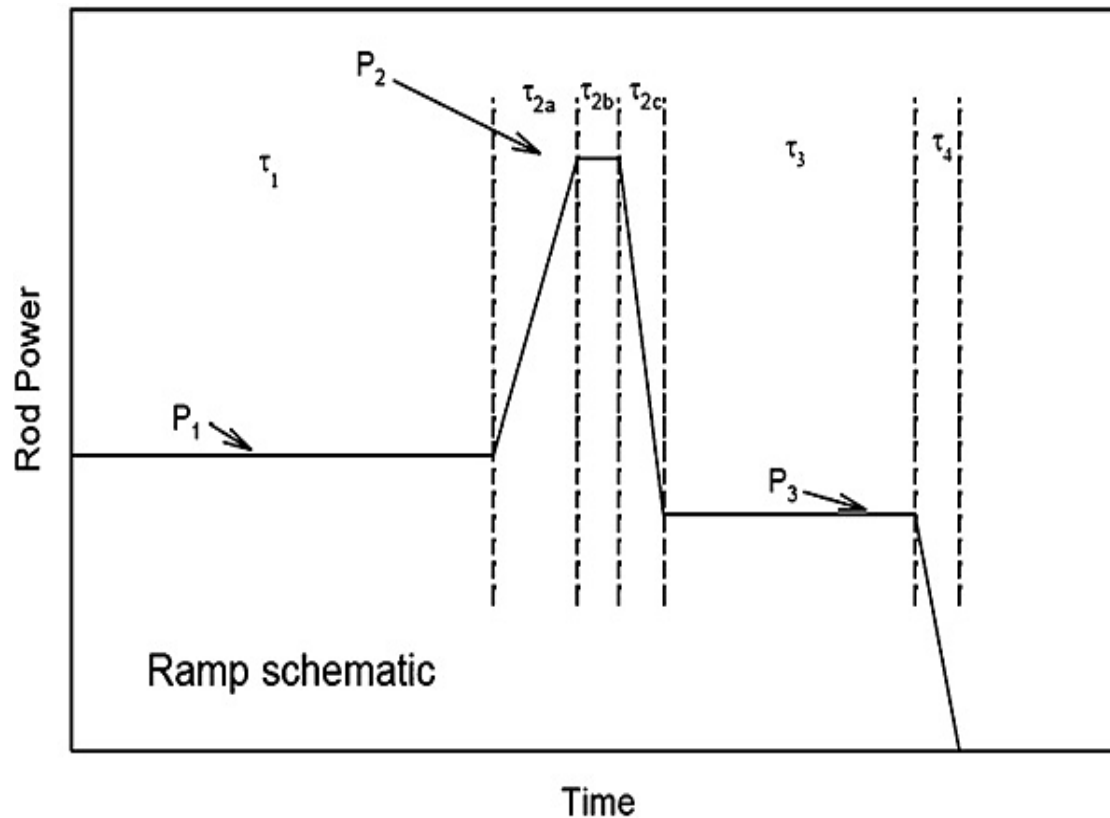
Baker's database (1977)

- **9 UO₂ samples, base-irradiated** at 9 different temperatures, from 1000°C to 1800°C (UKAEA's Winfrith SGHWR)
- Experimental data on small intra-granular bubbles from **TEM images**
- Burn-up: up to 23 GWd/t : reproduced with $F = 10^{19}$ fiss/(m³s) for $T = 5500$ h



White et al.'s database (2004)

Database of bubble density, radius and associated swelling measured in UO_2 samples: AGR-type fuel (Windscale: slightly enriched 2-3% UO_2 , higher density ~ 98% TD with respect to standard LWR fuel), irradiated in Halden Reactor.



White et al.'s database (2004)

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TEM

- 2 UO_2 samples: “control” samples, only base-irradiated
- 4 UO_2 samples, base-irradiated + power ramped (slow/fast ramp)
- **TEM images** in various radial points (4 – 6 per fuel pellet): small intra-bubbles

SEM

- 12 UO_2 samples, **base-irradiated + ramped / cycled in fission rate** (associated temperature and stress history)
- Experimental data from **SEM images** in various radial points (3 – 7 per fuel pellet): large intra-bubbles + inter-bubbles (3-D reconstructed).
 - **10 ramped samples:** burn-up after base-irradiation between 9 – 21 GWd/t
low linear power at 13 – 20 kW/m & T at 760 – 1020°C
high linear power at 36 – 43 kW/m & T at 1750 – 1920°C
 - **2 cycled samples (4159 & 4160):** burn-up after base-irradiation of 20 GWd/t
low linear power at 18 kW/m & T at 880°C
high linear power at 26 kW/m & T at 1360 / 1515°C

White et al.'s database (2004)

