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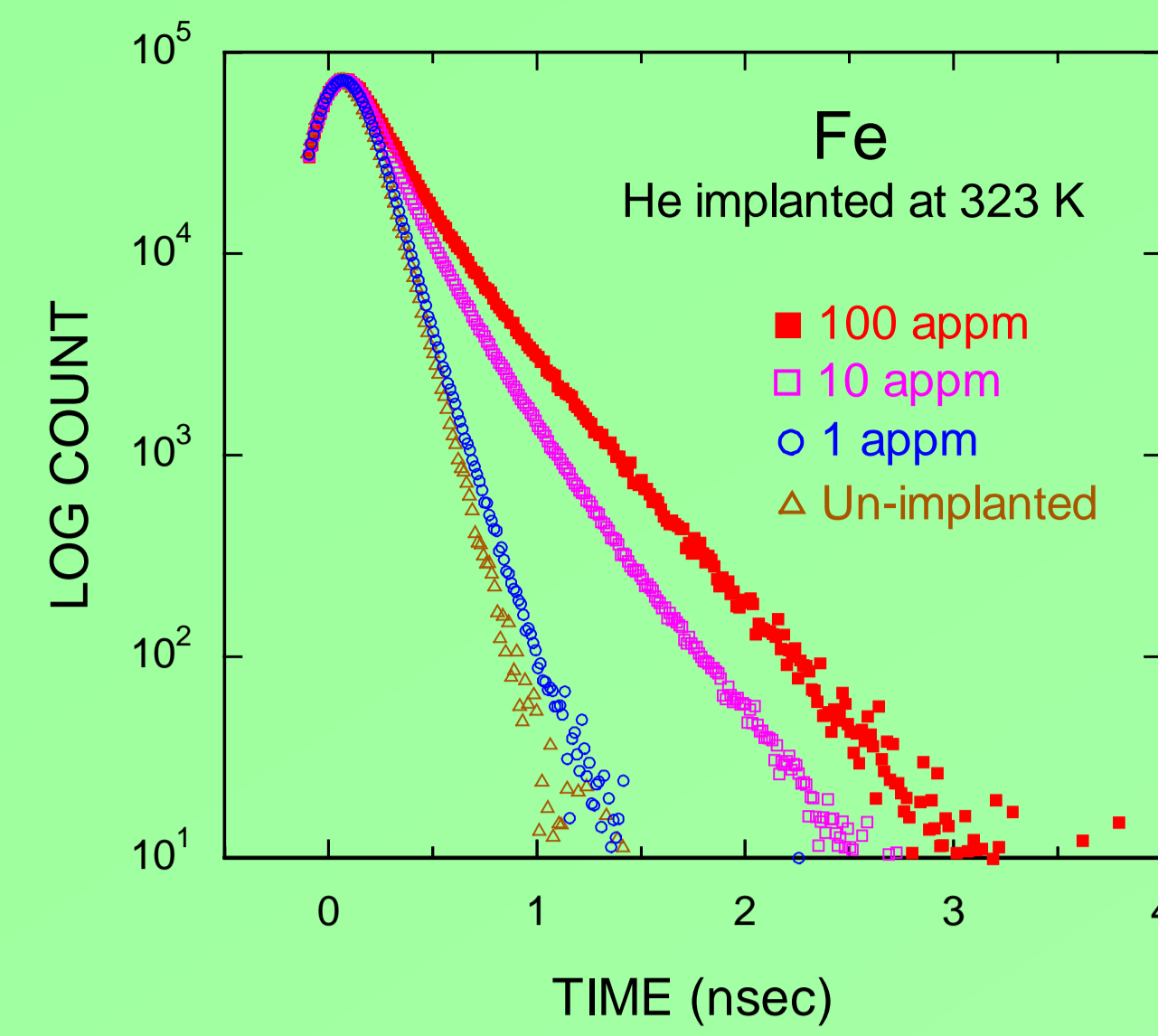
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Cavity nucleation and growth during helium implantation and neutron irradiation of Fe and steel

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Introduction:

In order to investigate the role of He in cavity nucleation in neutron irradiated iron and steel, pure iron and Eurofer-97 steel have been He implanted and neutron irradiated in a systematic way at different temperatures, to different He and neutron doses and with different He implantation rates.

The defect microstructure, in particular the cavities, was characterized using Positron Annihilation Lifetime Spectroscopy (PALS) and Transmission Electron Microscopy (TEM).

Experimental Details:

Specimens used for the experiments were pure iron and Eurofer-97. They were He implanted uniformly at the Jülich Compact Cyclotron. Subsequently many of the specimens were neutron irradiated in the BR-2 reactor at Mol, Belgium.

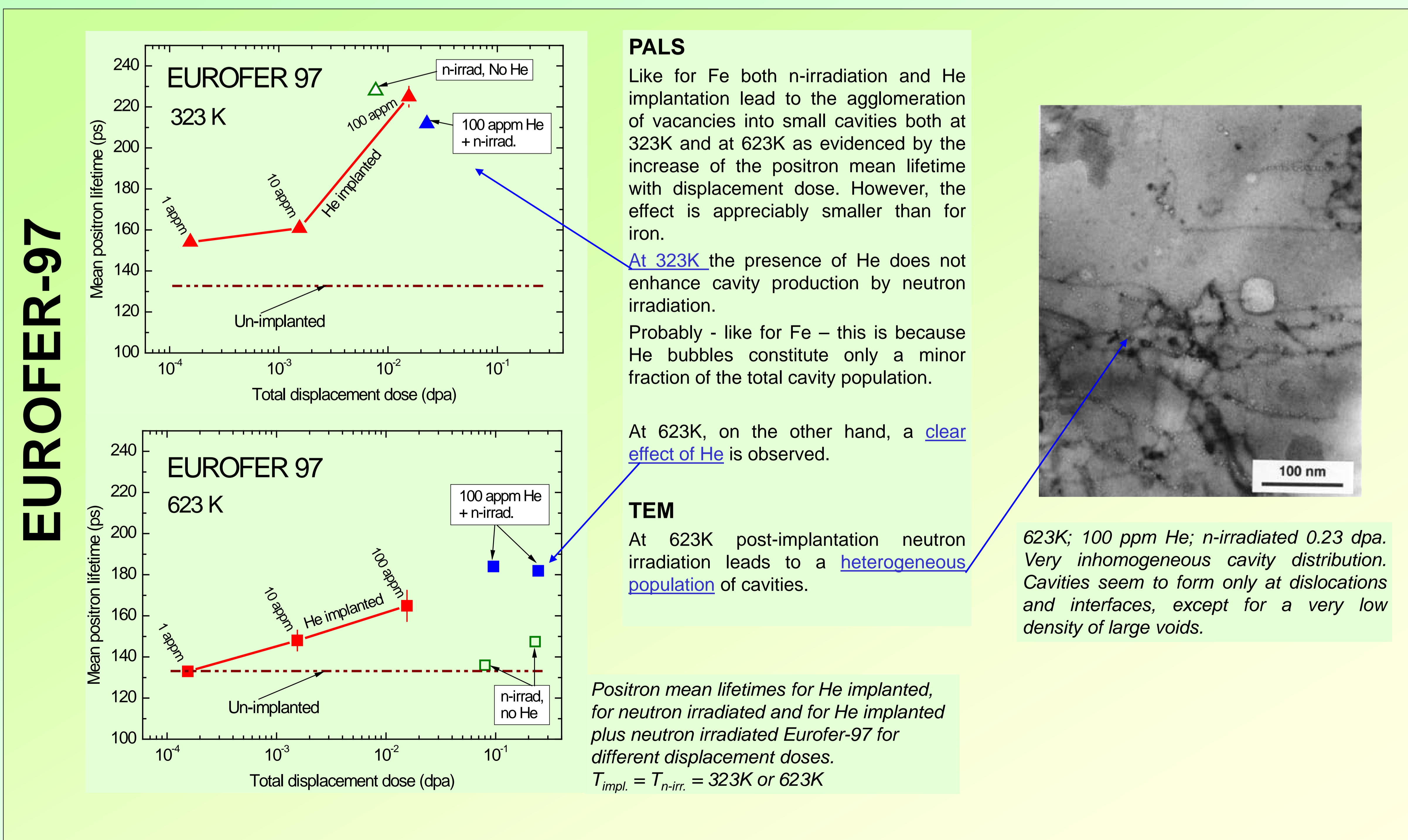
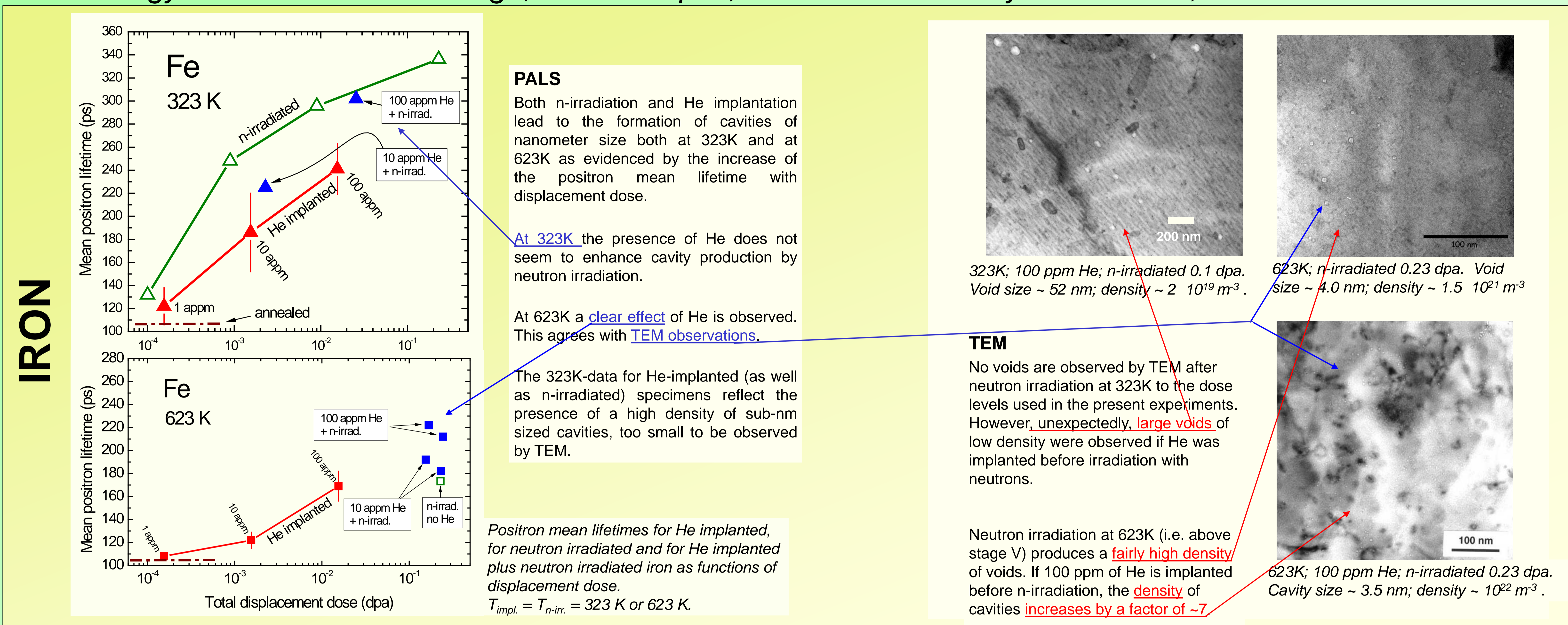
The He implantation and neutron irradiation parameters were:

$T_{impl} = T_{n-irr}$ (K)	He dose (appm)	He dose rate (appm/s)	Neutron dose (dpa)
~ 323 K	1, 10, 100	$6 \cdot 10^{-4}$ - $1.2 \cdot 10^{-2}$	0.001 – 0.1
623 K	1, 10, 100	$1.2 \cdot 10^{-3}$ - $1.2 \cdot 10^{-2}$	0.1 – 0.3

100 appm He gives rise to a displacement damage of 0.015 dpa.

PALS measurements were carried out on specimens that were He implanted, neutron irradiated or neutron irradiated after He implantation. Results are presented here in the form of positron mean lifetimes.

A few of the specimens were also investigated by TEM.



Summary:

This poster gives a brief overview of a study of the microstructure, in particular the cavity population, in iron and Eurofer-97 after He implantation and neutron irradiation.

Both He implantation and neutron irradiation create populations of cavities.

At 323K pre-implantation of He only influences the effect of neutron irradiation to a small extent..

At 623K on the other hand, He strongly enhances the density of cavities after neutron irradiation.