Rockwell Hardness Sensitivity Coefficients HRC

ISO 6508-1 defines the Rockwell C hardness value, *HRC*, as:

$$HRC = 100 - \frac{h}{2}$$

where:

h = permanent depth of indentation under preliminary test force after removal of additional test force (in μm)

A partial derivative allows the sensitivity coefficient for indentation depth to be determined:

$$\frac{\partial HRC}{\partial h} = -0.5$$

A document (EA-10/16) published by the European co-operation for Accreditation details the values of other sensitivity coefficients for *HRC*, obtained by experiment at three different hardness levels. These are given in the following table, and then plotted in blue in the subsequent graphs (the green lines represent results obtained at NIST, the red lines results from IMGC, and the purple lines results from NPL):

Sensitivity coefficient	Hardness level		
	20 to 25 HRC	40 to 45 HRC	60 to 65 HRC
$\dfrac{\partial HRC}{\partial F_0}$	0.12	0.07	0.05
$\dfrac{\partial HRC}{\partial F}$	-0.04	-0.03	-0.02
$\dfrac{\partial HRC}{\partial \alpha}$	1.3	0.8	0.4
$\dfrac{\partial HRC}{\partial r}$	0.015	0.03	0.05
$\dfrac{\partial HRC}{\partial v}$	-0.02	0.0	0.03
$\dfrac{\partial HRC}{\partial t_0}$	0.01	0.005	0.004
$\dfrac{\partial HRC}{\partial t}$	-0.07	-0.04	-0.03

where:

F_0 = preliminary test force (in N)
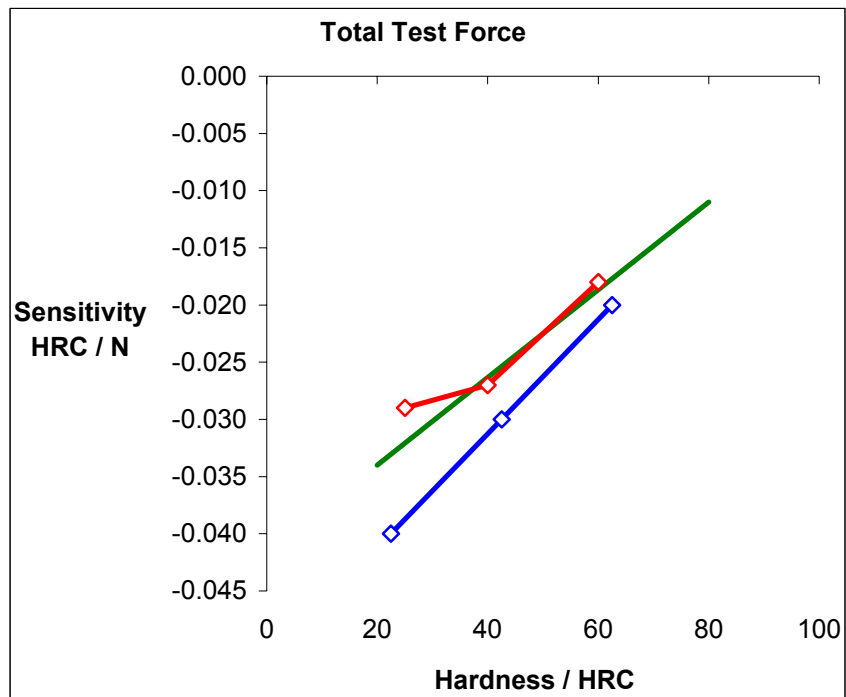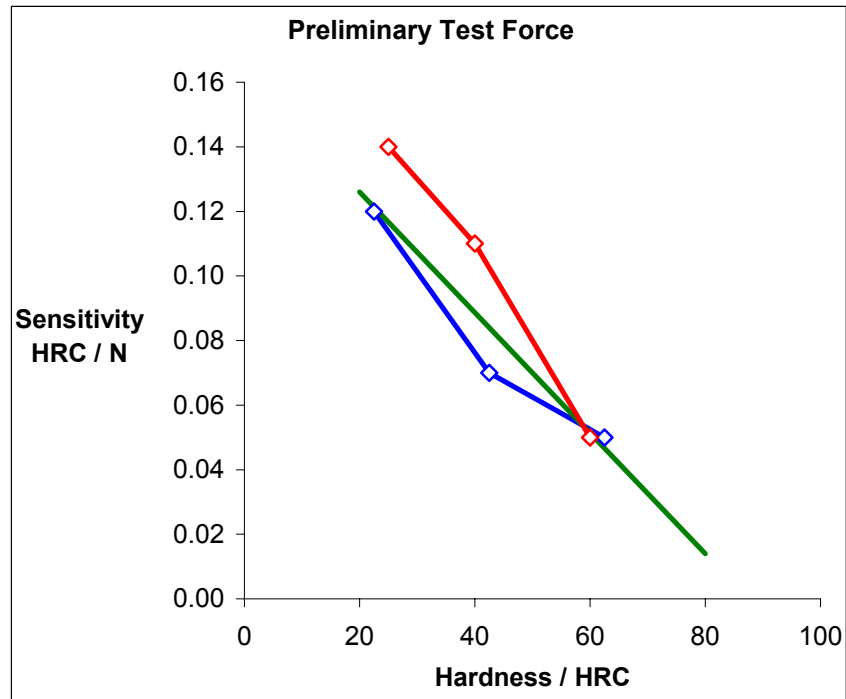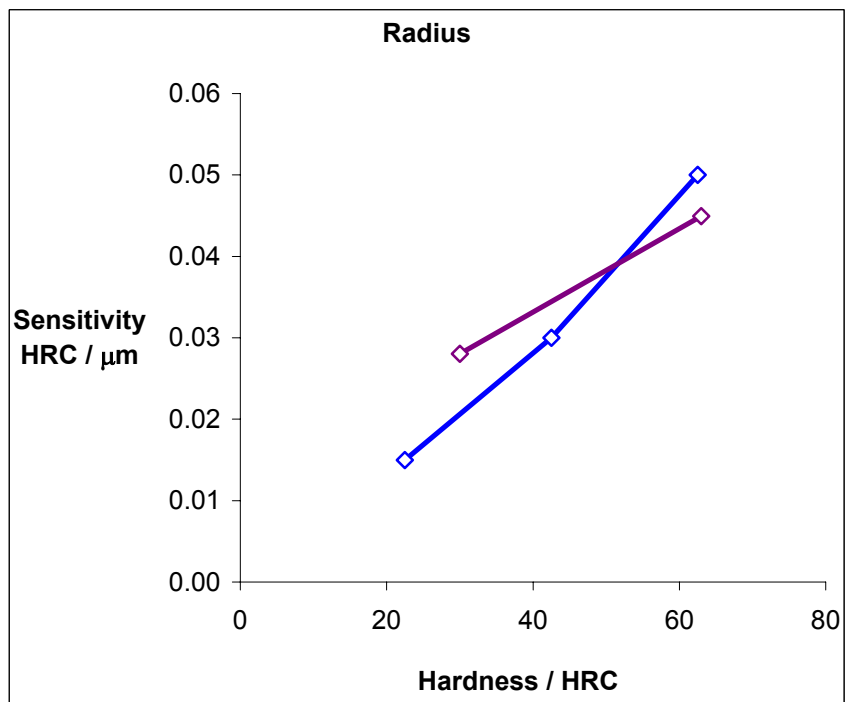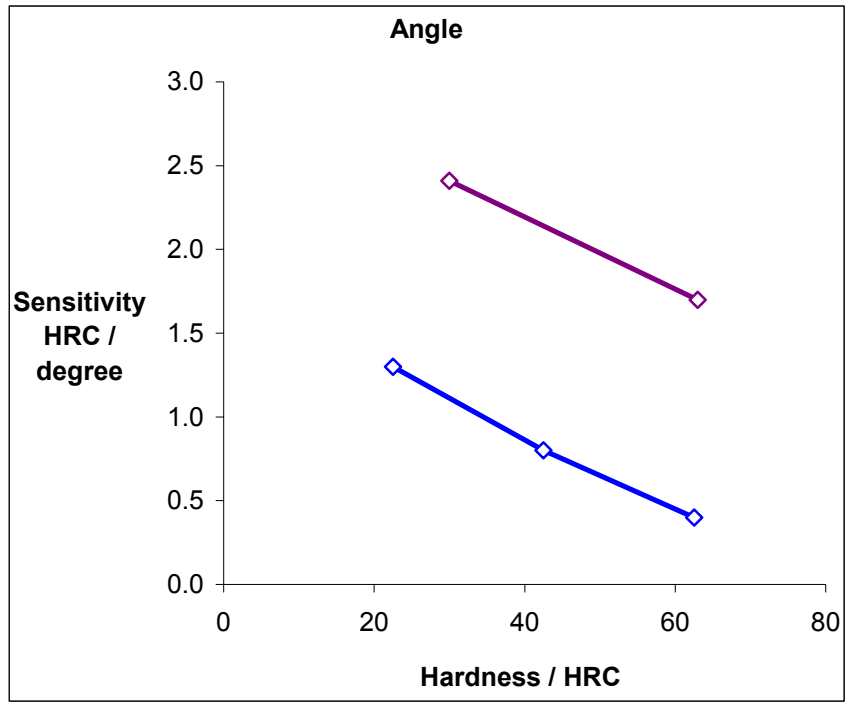F = total test force (in N)
α = indenter angle (in °)
r = indenter radius (in μm)
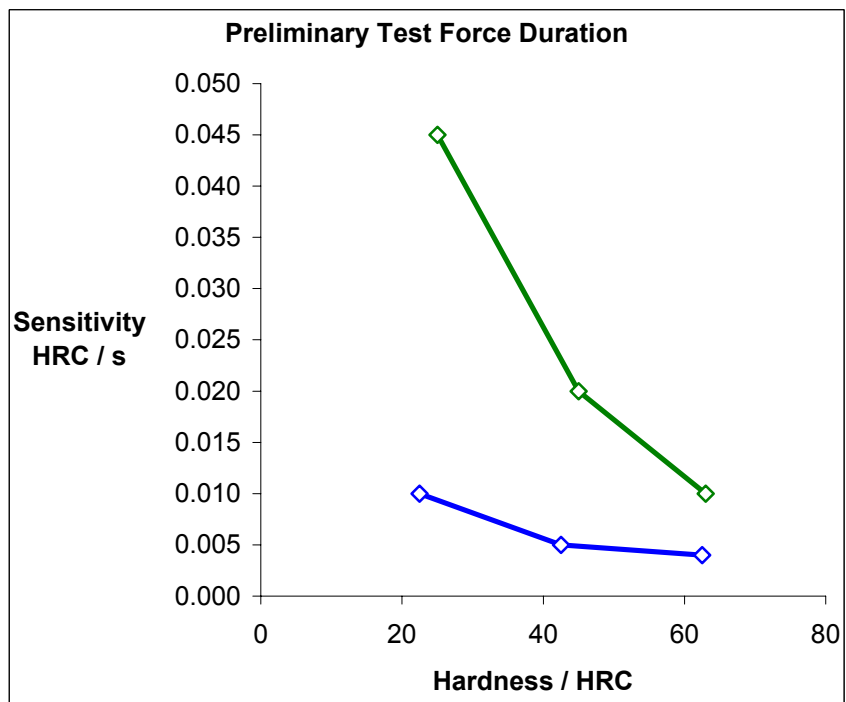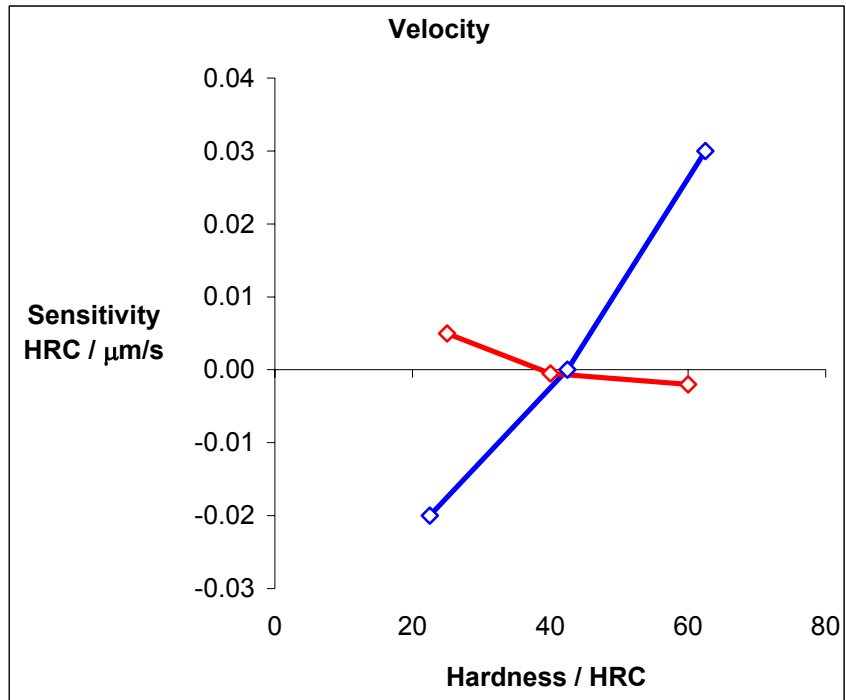v = indentation velocity (in μm·s^{-1})
t_0 = preliminary test force dwell time (in s)
t = total test force dwell time (in s)

Preliminary Test Force

Sensitivity HRC / N

Hardness / HRC

Total Test Force

Sensitivity HRC / N

Hardness / HRC

Angle

Sensitivity
HRC /
degree

Hardness / HRC

Radius

Sensitivity
HRC / μm

Hardness / HRC

Velocity

Sensitivity HRC / μm/s vs Hardness / HRC

Preliminary Test Force Duration

Sensitivity HRC / s vs Hardness / HRC

Total Test Force Duration
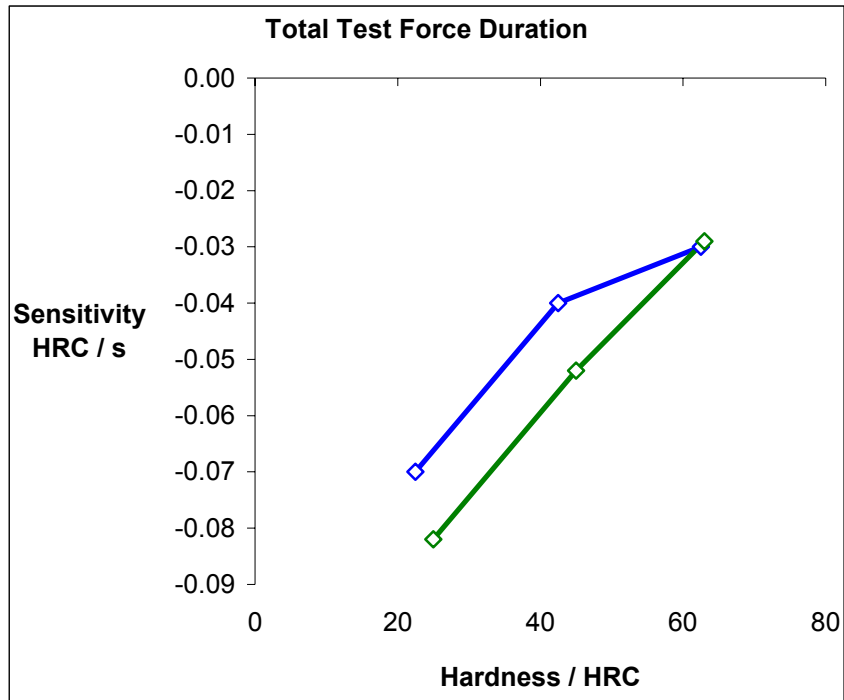
The following graph shows the sensitivity of the HRC scale to the time taken to make the final reading, as measured at NIST.

Final Reading Stabilisation Time