

Supplementary Material for: " **Evaluating creep deformation in controlled microstructures of Sn-3Ag-0.5Cu solder**"

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Video S1. The DIC fields of the [100] [110] bi-crystal sample at the onset secondary stage (see corresponding video file).

Video S2. The DIC fields of the [100] [110] bi-crystal sample at the tertiary stage (see corresponding video file).

Video S3. The DIC fields of the [110] single crystal sample at the onset secondary stage (see corresponding video file).

Video S4. The DIC fields of the [110] single crystal sample at the tertiary stage (see corresponding video file).

T [K]	Strain at onset of secondary creep (%)	Secondary creep strain rate (% s ⁻¹)	Secondary creep strain rate (s ⁻¹)	Failure creep strain (%)	Number of β -Sn grains	β -Sn Orientation measured by EBSD
298	1.78	3.79×10^{-4}	3.79×10^{-6}	6.8	1	[110]
318	0.80	7.65×10^{-4}	7.65×10^{-6}	5.5	3	[110] [110] [100]
	0.86	6.76×10^{-4}	6.76×10^{-6}	9.8	2	[110] [110]
333	0.44	1.50×10^{-3}	1.50×10^{-5}	13.6	3	[100] [100] [110]
	0.49	1.20×10^{-3}	1.20×10^{-5}	7.2 (not fractured)	-	-
363	0.38	2.18×10^{-3}	2.18×10^{-5}	10.7	3	[100] [110] [100]
	0.35	1.92×10^{-3}	1.92×10^{-5}	16.9	1	[100]
393	0.30	2.51×10^{-3}	2.51×10^{-5}	22.2	3	[100] [110] [100]
	0.27	2.63×10^{-3}	2.65×10^{-5}	9.6 (not fractured)	2	[110] [100]
423	0.15	2.87×10^{-3}	2.87×10^{-5}	42.3	3	[110] [110] [110]
	0.18	2.77×10^{-3}	2.46×10^{-5}	25.2	-	-
453	0.09	2.82×10^{-3}	2.82×10^{-5}	29.4	3	[110] [110] [110]
	0.12	2.92×10^{-3}	2.99×10^{-5}	26.3	-	-
473	0.01	3.26×10^{-3}	3.26×10^{-5}	34.2	2	[110] [110]
	0.01	3.52×10^{-3}	4.21×10^{-5}	29.8 (not fractured)	-	-

Table S1: Summarisation of mechanical creep SAC305 samples from fixed load (~30MPa) testing from 298 to 473 K showing the values of secondary creep strain rate, onset of secondary strain, and orientation.

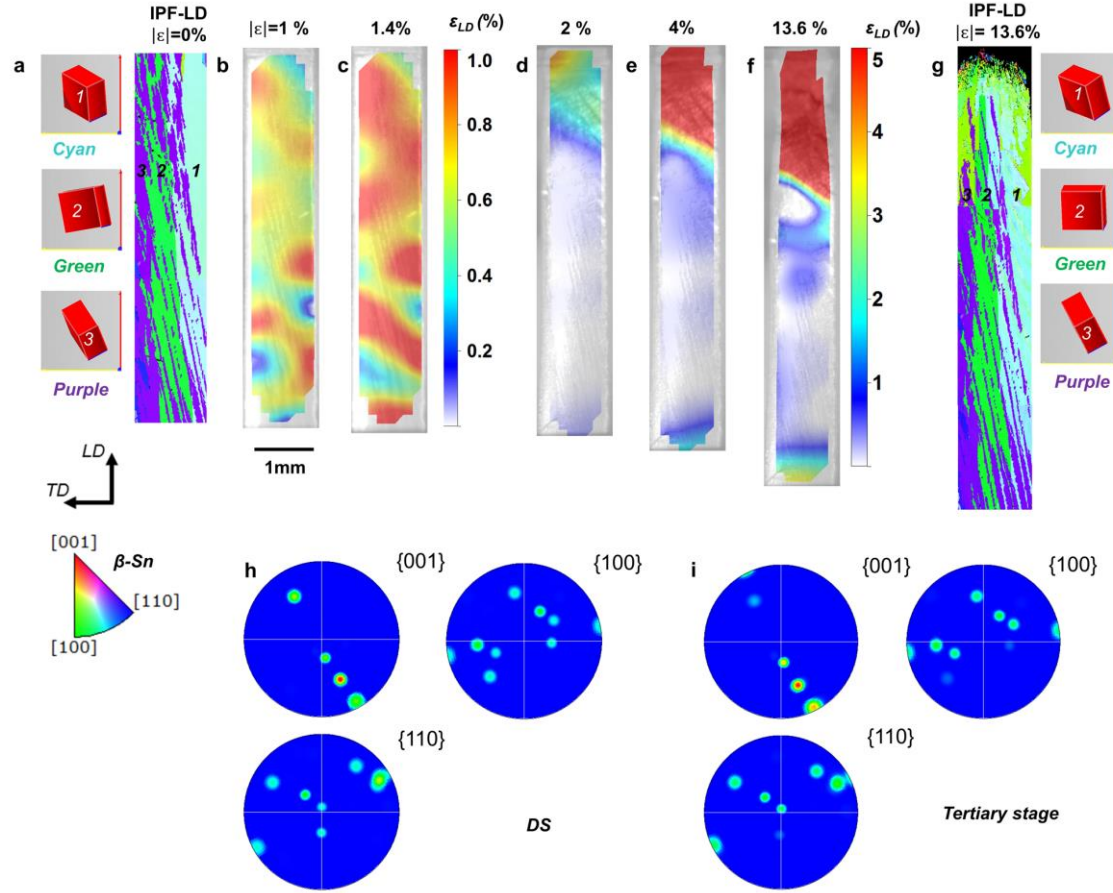


Figure S1. The DIC figures and IPF-LD map of a tri-crystal sample crept at 60°C. (a) The IPF-LD map after DS ($\epsilon_{LD} = 0\%$) with main crystal orientation shown. (b-c) DIC figures interrupted at the onset of secondary stage creep at strain level (ϵ_{LD}) 1% and 1.4% respectively. (d-f) DIC figures at tertiary stage creep (fracture) at strain level 2%, 4% and 13.6% respectively. (g) The IPF-LD map at fracture ($\epsilon_{LD} = 13.6\%$) with the main orientation shown. The PF of the sample at DS condition (h), at tertiary stage creep (i).

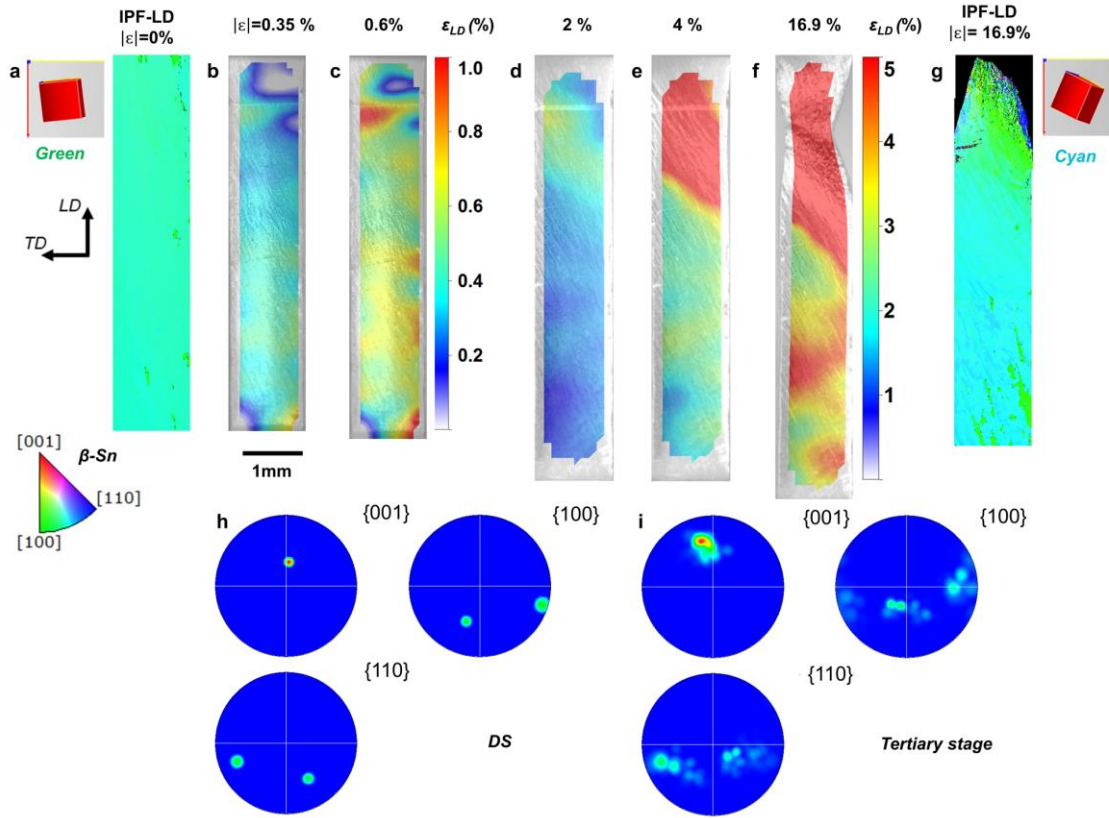


Figure S2. The DIC figures and IPF-LD map of a single-crystal sample crept at 90°C. (a) The IPF-LD map after DS ($\epsilon_{LD} = 0\%$) with main crystal orientation shown. (b-c) DIC figures interrupted at the onset of secondary stage creep at strain level (ϵ_{LD}) 0.8% and 1.2% respectively. (d-f) DIC figures at tertiary stage creep (fracture) at strain level 2%, 4% and 16.9% respectively. (g) The IPF-LD map at fracture ($\epsilon_{LD} = 16.9\%$) with the main orientation shown. The PF of the sample at DS condition (h), at tertiary stage creep (i).

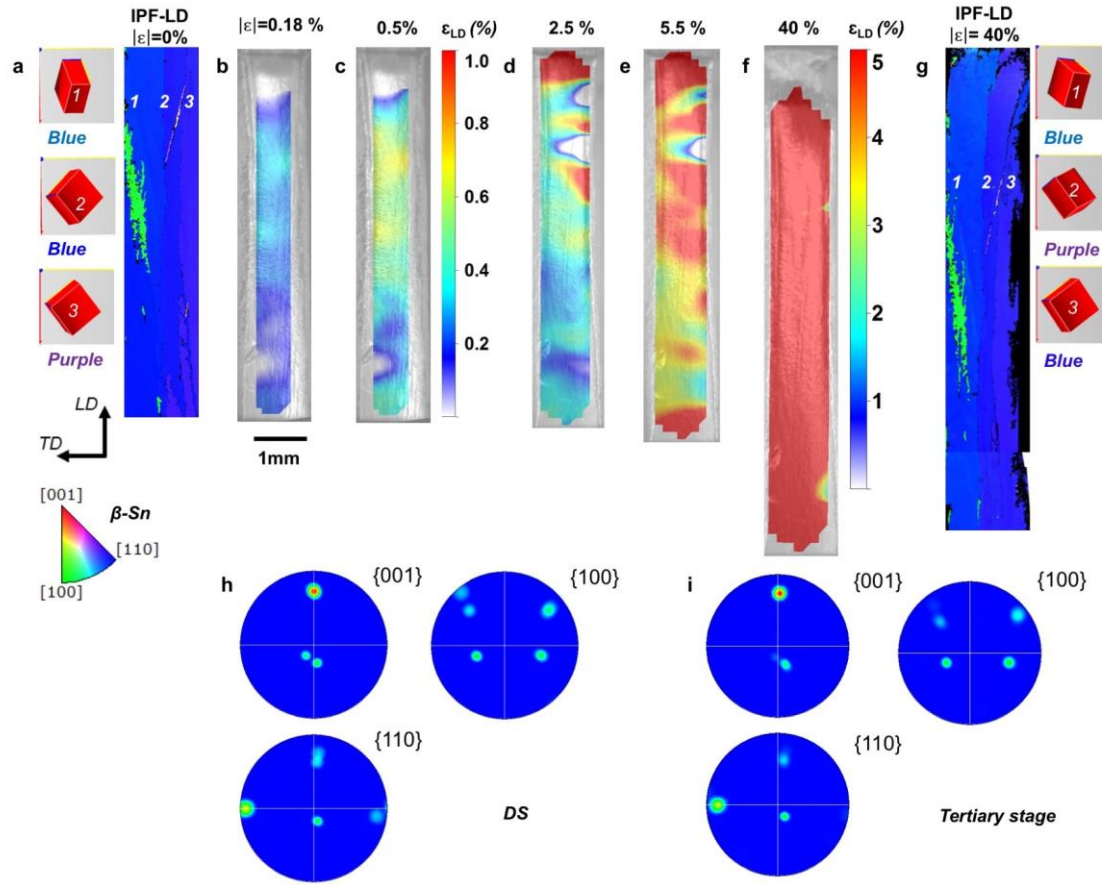


Figure S3. The DIC figures and IPF-LD map of a tri-crystal sample crept at 150°C. (a) The IPF-LD map after DS ($\epsilon_{LD} = 0\%$) with main crystal orientations shown. (b-c) DIC figures interrupted at the onset of secondary stage creep at strain level (ϵ_{LD}) 0.18% and 0.5% respectively. (d-f) DIC figures at tertiary stage creep (fracture) at creep strain level 2.5%, 5.5% and 40% respectively. (g) The IPF-LD map at fracture ($\epsilon_{LD} = 40\%$) with the main orientations shown. The PF of the sample at DS condition (h), at tertiary stage creep (i).

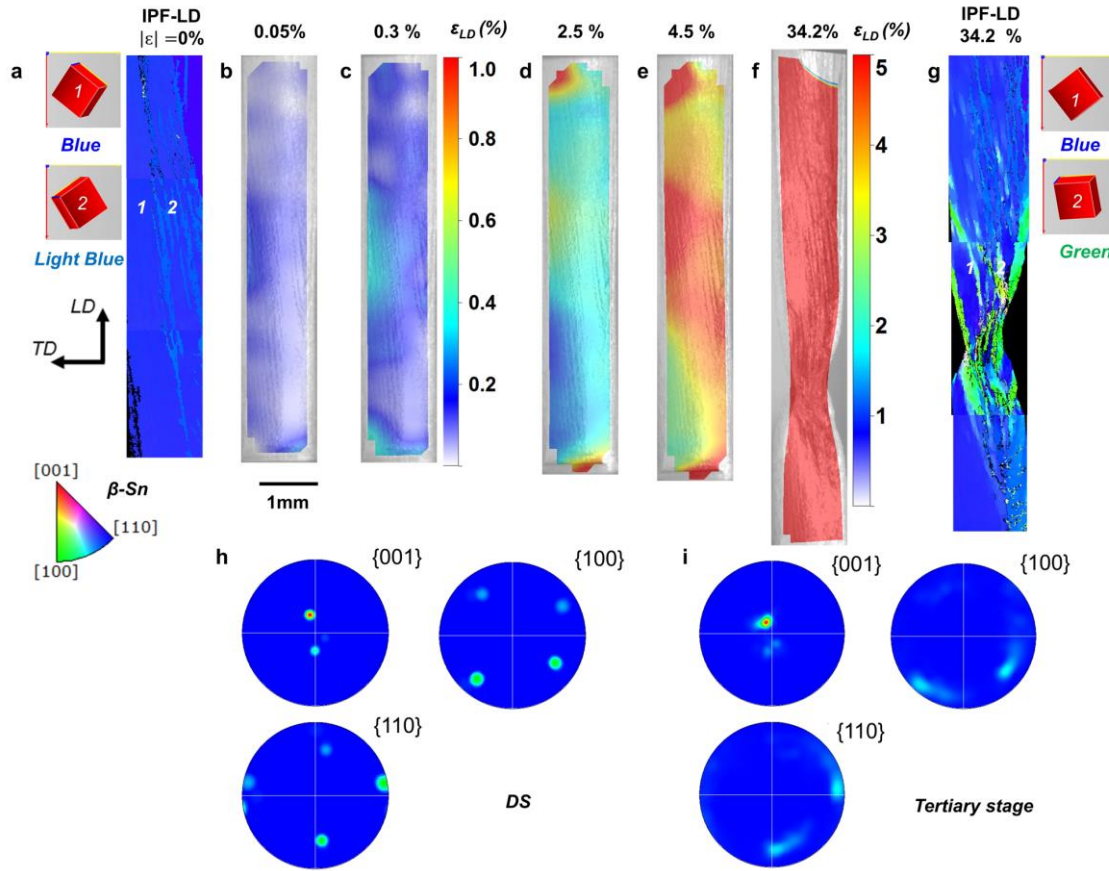


Figure S4. The DIC figures and IPF-LD map of a Bi-crystal sample crept at 200°C. (a) The IPF-LD map after DS ($\epsilon_{LD} = 0\%$) with main crystal orientation shown. (b-c) DIC figures interrupted at the onset of secondary stage creep at strain level (ϵ_{LD}) 0.05% and 0.3% respectively. (d-f) DIC figures at tertiary stage creep at strain level 2.5%, 4.5% and 34.2% respectively. (g) The IPF-LD map at failure ($\epsilon_{LD} = 34.2\%$) with the main orientation shown. The PF of the sample at DS condition (h), at tertiary stage creep (i).