Supplementary Material

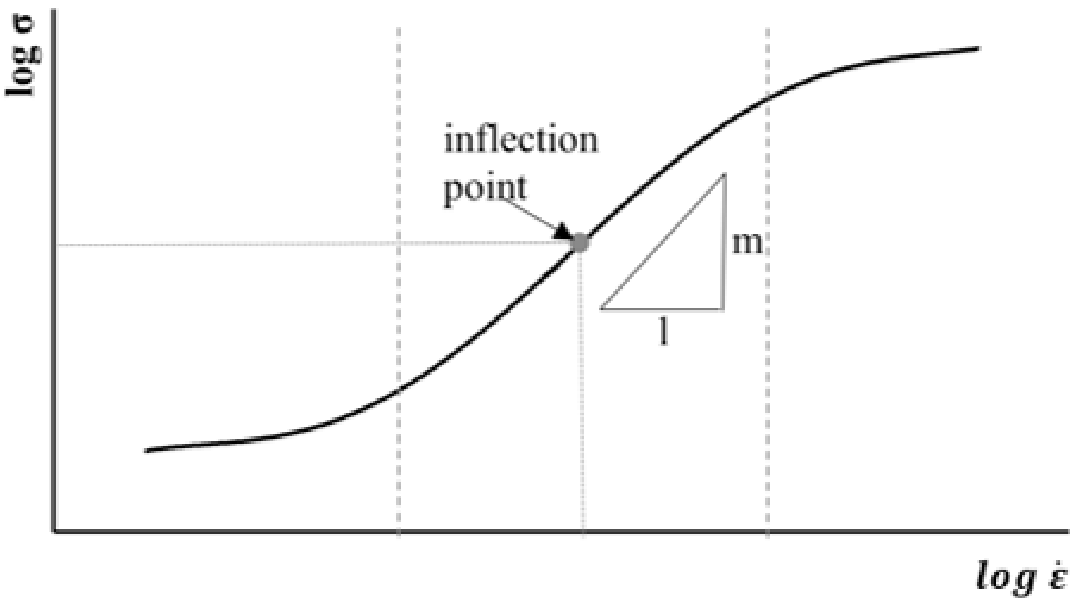

Fig. S1. Sigmoidal nature of superplastic deformation [2].

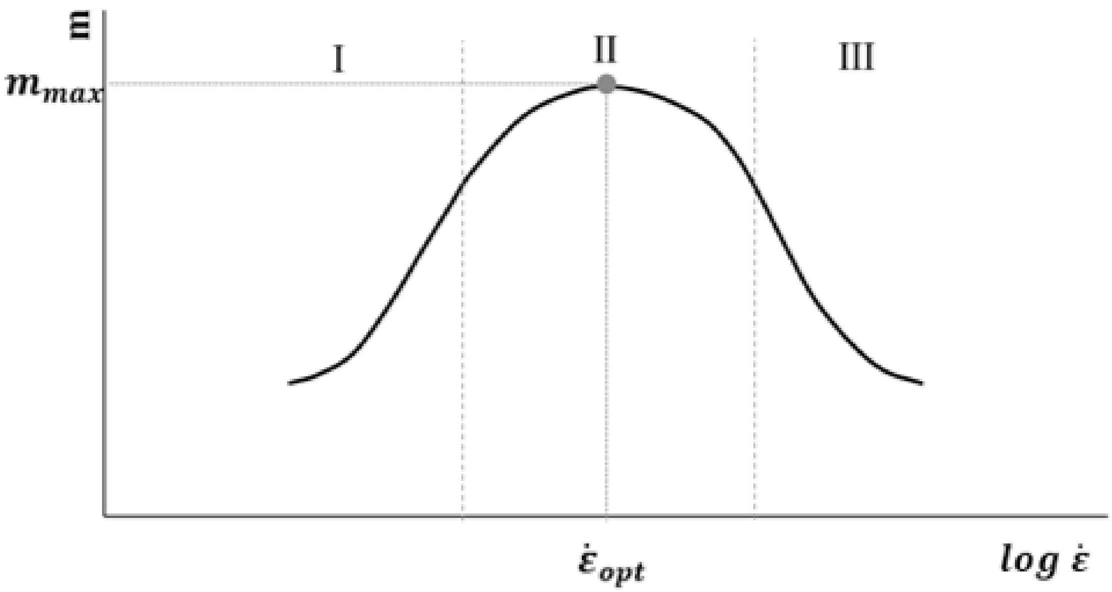

Fig. S2. Variation of the strain rate sensitivity index with strain rate [2].

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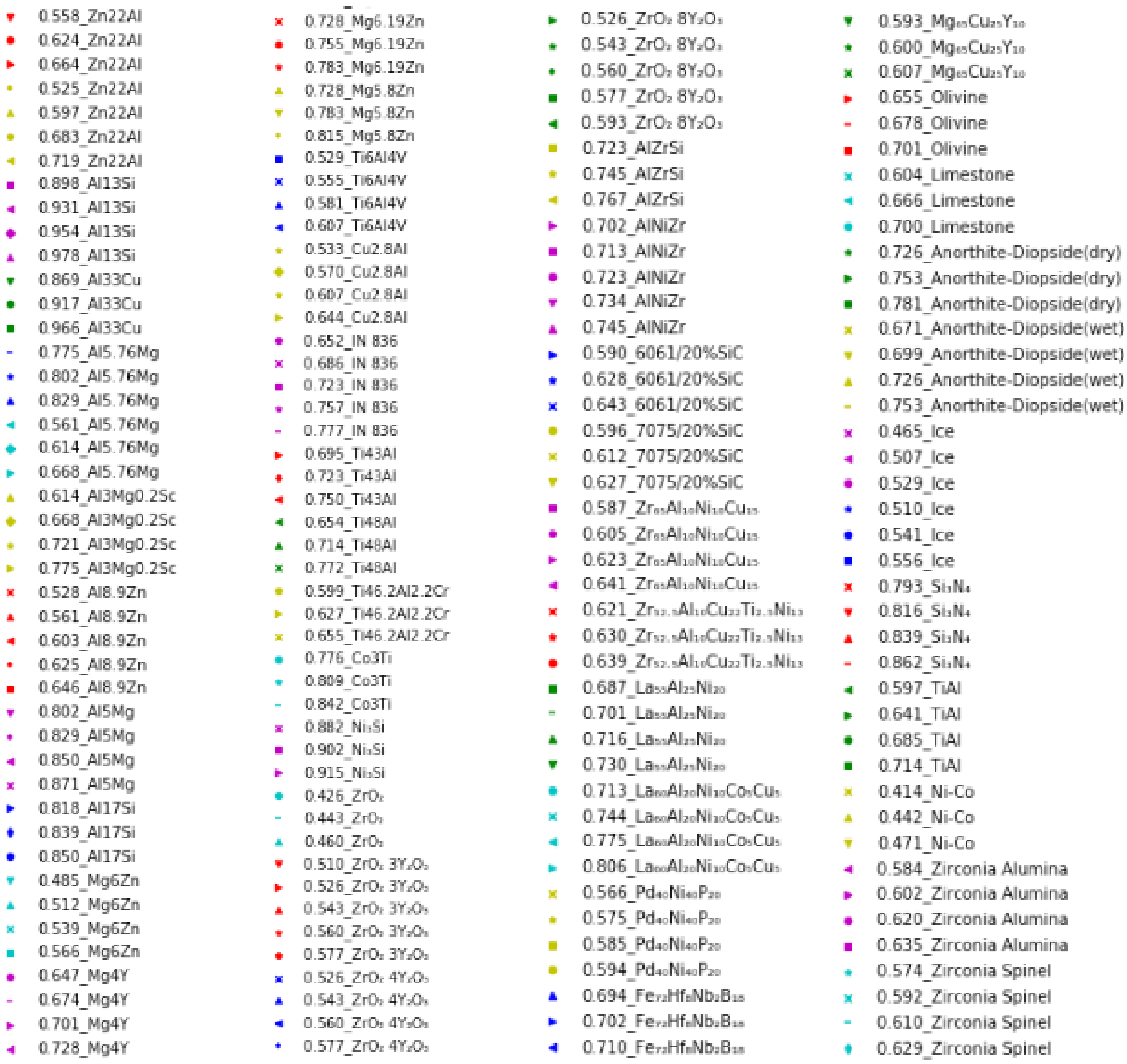

Fig. S3. (Color online) Legends for the symbols used in the paper.

Table S1. Normalization details of the superplastic materials whose experimental data were analyzed.

Systems	Grain size(μm)	T_{hom}	σ_{opt} (MPa)	$\dot{\varepsilon}$ (s^{-1})	m_{max}	p_0	σ_c (MPa)	η_{abs} (Pas)	Q/kT_m	
									$\nu=kT/h$ (s^{-1})	$\nu=10^{13}$ (s^{-1})
Metals and alloys										
Zn 22Al [43]	2.5	0.558	25.76	9.40×10^{-3}	0.48	4.54	26.05	9.20×10^8	9.49	10.09
		0.624	16.25	14.03×10^{-3}	0.48	4.03	18.97	2.72×10^8		
		0.664	13.50	26.30×10^{-3}	0.49	3.85	14.96	2.14×10^8		
Zn 22Al [44]	0.9	0.525	41.78	2.79×10^{-4}	0.36	4.13	56.60	186×10^8	12.86	13.57
		0.597	20.09	6.25×10^{-4}	0.43	3.04	30.14	90×10^8		
		0.683	13.47	1.05×10^{-3}	0.45	2.69	20.79	24.6×10^8		
		0.719	9.01	1.97×10^{-3}	0.51	2.40	13.87	10×10^8		

Al 13Si [45]	18	0.898	1.92	6.70×10^{-5}	0.33	4.41	3.29	32.7×10^{8}	16.88	17.62
		0.931	1.61	9.40×10^{-5}	0.393	3.65	2.57	19.3×10^{8}		
		0.954	1.36	1.65×10^{-4}	0.43	3.21	2.12	16.7×10^{8}		
		0.978	1.30	2.15×10^{-4}	0.44	2.90	1.78	13.4×10^{8}		
Al 33Cu 0.4Zr [46]	7.6	0.869	4.81	1.72×10^{-3}	0.38	5.77	5.10	9.54×10^{8}	20.60	21.20
		0.917	2.76	2.45×10^{-3}	0.51	3.39	3.25	3.21×10^{8}		
		0.966	2.87	11.97×10^{-3}	0.60	2.78	2.89	0.83×10^{8}		
Al 5.76Mg 0.32Sc 0.3Mn [47]	3	0.775	16.59	8.60×10^{-3}	0.384	3.78	26.70	2.95×10^{8}	15.61	16.40
		0.802	13.71	10.20×10^{-3}	0.40	3.60	22.79	2.02×10^{8}		
		0.829	9.27	14.73×10^{-3}	0.417	3.40	19.29	0.62×10^{8}		
Al 5.76Mg 0.32Sc 0.3Mn [48]	1	0.561	79.25	2.33×10^{-3}	0.38	7.20	85.84	99.5×10^{8}	14.48	15.07
		0.614	49.0	8.40×10^{-3}	0.44	6.97	52.87	17.7×10^{8}		
		0.668	32.63	23.75×10^{-3}	0.465	6.90	33.30	4.48×10^{8}		
Al 3Mg 0.2Sc [49]	0.2	0.614	48.59	7.96×10^{-3}	0.435	4.54	82.03	10×10^{8}	15.43	16.06
		0.668	31.91	22.35×10^{-3}	0.46	4.18	78.69	1.38×10^{8}		
		0.721	20.15	13.64×10^{-3}	0.45	2.65	51.43	1.33×10^{8}		
		0.775	15.25	15.37×10^{-3}	0.48	2.02	41.27	1.06×10^{8}		
Al 8.9Zn 2.6Mg 0.009Sc [50]	0.7	0.528	90.38	3.01×10^{-3}	0.35	4.74	111.9	57.9×10^{8}	16.25	16.83
		0.561	57.61	5.09×10^{-3}	0.474	3.55	74.93	27.9×10^{8}		
		0.603	44.81	20.49×10^{-3}	0.479	3.45	68.04	4.6×10^{8}		
		0.625	47.18	61.7×10^{-3}	0.453	3.40	60.88	1.87×10^{8}		
		0.646	26.47	49.62×10^{-3}	0.40	3.37	54.25	0.54×10^{8}		
Al 5Mg 0.18Mn 0.2Sc [51]	24	0.802	12.31	8.81×10^{-3}	0.483	4.46	22.85	2.85×10^{8}	16.05	16.88
		0.829	9.27	7.88×10^{-3}	0.527	3.44	15.34	2.47×10^{8}		
		0.850	6.16	4.99×10^{-3}	0.557	3.16	12.1	2.36×10^{8}		
		0.871	5.11	5.67×10^{-3}	0.62	2.90	9.64	2.0×10^{8}		
Al 17Si 2Fe 2Mg 1Cu 1Ni [52]	1.4	0.818	63.46	974×10^{-3}	0.34	5.10	67.77	0.19×10^{8}	13.47	14.32
		0.839	44.80	954×10^{-3}	0.45	4.22	51.74	0.14×10^{8}		
		0.850	27.89	973×10^{-3}	0.405	2.90	32.86	0.09×10^{8}		
		0.861	21.29	954×10^{-3}	0.5	2.70	28.35	0.07×10^{8}		
Mg 6Zn 0.8Zr [53]	0.7	0.485	68.51	2.3×10^{-3}	0.41	5.32	125.9	26.1×10^{8}	14.96	15.48
		0.512	79.84	20.24×10^{-3}	0.445	4.71	109.9	9.45×10^{8}		
		0.539	73.84	76.79×10^{-3}	0.447	4.34	99.83	2.20×10^{8}		
		0.566	54.04	188.8×10^{-3}	0.431	3.56	80.72	0.56×10^{8}		
Mg 4Y 0.7Zr 0.4Nd [54]	2	0.647	32.40	0.77×10^{-3}	0.486	6.28	95.33	33.9×10^{8}	16.35	17.04
		0.674	40.85	7.76×10^{-3}	0.45	4.46	72.15	19.6×10^{8}		
		0.701	46.73	34.98×10^{-3}	0.485	3.70	63.83	3.2×10^{8}		
		0.728	53.36	58.35×10^{-3}	0.535	3.35	61.62	2.29×10^{8}		
Mg 6.19Zn 1.1Y 0.46Zr [55]	5.2	0.728	2.70	0.33×10^{-3}	0.538	4.25	7.45	11.1×10^{8}	15.81	16.56
		0.755	3.00	0.86×10^{-3}	0.434	3.35	6.06	5.46×10^{8}		
		0.783	4.62	3.92×10^{-3}	0.51	3.01	5.60	3.93×10^{8}		
Mg 5.8Zn 1Y 0.48Zr [56]	17.5	0.728	15.32	0.86×10^{-3}	0.377	5.94	20.45	10.2×10^{8}	14.39	15.16
		0.783	7.18	0.71×10^{-3}	0.466	3.35	12.60	4.92×10^{8}		
		0.815	3.04	0.33×10^{-3}	0.53	2.82	11.60	3.72×10^{8}		
Ti 6Al 4V [57]	0.9	0.529	41.85	0.184×10^{-3}	0.473	5.33	94.77	293×10^{8}	14.09	14.65
		0.555	46.0	0.418×10^{-3}	0.504	5.02	91.34	181×10^{8}		
		0.581	48.36	0.767×10^{-3}	0.548	4.50	83.94	131×10^{8}		
		0.607	44.67	1.384×10^{-3}	0.536	3.86	74.04	68.7×10^{8}		
Cu 2.8Al 1.8Si 0.4Co [58]	7	0.533	41.78	0.274×10^{-3}	0.36	5.60	56.60	293×10^{8}	12.86	13.57
		0.570	20.79	0.625×10^{-3}	0.47	4.12	30.14	181×10^{8}		
		0.607	13.47	1.03×10^{-3}	0.45	3.93	20.79	131×10^{8}		
		0.644	9.01	1.97×10^{-3}	0.515	3.62	13.87	68.7×10^{8}		
IN836 [59]	2.5	0.652	66.09	0.304×10^{-3}	0.33	6.01	80.77	502.61×10^{8}	13.29	13.97
		0.686	45.93	0.353×10^{-3}	0.35	5.31	56.99	294.1×10^{8}		
		0.723	30.60	0.47×10^{-3}	0.38	4.58	39.26	149.0×10^{8}		
		0.757	17.62	0.198×10^{-3}	0.44	4.02	27.45	86.61×10^{8}		
		0.777	20.53	0.30×10^{-3}	0.45	3.84	21.02	47.93×10^{8}		

Intermetallics										
Ti 43Al [60]	5.0	0.695	38.91	0.037×10^{-3}	0.59	3.92	55.17	2.48×10^{11}	16.92	17.61
		0.723	39.52	0.157×10^{-3}	0.56	3.64	53.86	9.69×10^{10}		
		0.750	21.01	0.107×10^{-3}	0.59	2.54	39.52	3.0×10^{10}		
Ti 48Al [61]	0.9	0.654	103.5	0.1×10^{-3}	0.444	5.02	150.0	2.16×10^{11}	16.73	17.48
		0.716	31.28	0.23×10^{-3}	0.734	2.70	57.40	3.59×10^{10}		
		0.772	29.17	1.47×10^{-3}	0.75	2.61	39.52	5.75×10^{9}		
Ti 46.2Al 2.2Cr [62]	0.8	0.599	143.5	0.057×10^{-3}	0.492	5.03	167.6	7.0×10^{11}	17.57	18.20
		0.627	84.33	0.053×10^{-3}	0.515	4.41	114.9	3.9×10^{11}		
		0.655	36.59	0.049×10^{-3}	0.754	2.81	57.2	2.13×10^{11}		
Co3Ti [63]	24	0.776	167.5	0.11×10^{-3}	0.40	3.60	180.8	4.52×10^{11}	18.80	19.61
		0.809	135.8	0.25×10^{-3}	0.53	3.02	153.4	1.61×10^{11}		
		0.842	133.8	0.66×10^{-3}	0.58	2.93	150.4	5.75×10^{10}		
Ni3Si [64]	15	0.882	24.92	2.56×10^{-3}	0.51	3.88	32.35	2.25×10^{9}	16.59	17.48
		0.902	17.59	4.56×10^{-3}	0.59	3.47	22.0	1.1×10^{9}		
		0.915	8.88	4.45×10^{-3}	0.58	2.97	14.0	5.6×10^{8}		
Ceramics/Composites										
ZrO_2 [65]	0.07	0.426	409.5	0.22×10^{-3}	0.448	5.33	436.8	5779×10^{8}	13.31	13.75
		0.443	356.3	0.519×10^{-3}	0.422	4.98	432.1	1756×10^{8}		
		0.460	243.8	0.582×10^{-3}	0.444	3.18	292.1	1111×10^{8}		
ZrO_2 3Y [66]	0.51	0.510	88.27	0.085×10^{-3}	0.529	4.96	91.4	3370×10^{8}	14.92	15.45
		0.526	46.90	0.116×10^{-3}	0.544	3.31	57.98	1130×10^{8}		
		0.543	44.22	0.264×10^{-3}	0.524	3.17	52.8	475.5×10^{8}		
		0.560	26.42	0.29×10^{-3}	0.540	2.66	42.06	212×10^{8}		
		0.577	22.30	0.312×10^{-3}	0.536	2.16	32.36	172×10^{8}		
ZrO_2 4Y [67]	0.75	0.526	61.28	0.093×10^{-3}	0.49	5.53	86.42	1730×10^{8}	13.66	14.21
		0.543	45.5	0.181×10^{-3}	0.482	4.06	63.0	662×10^{8}		
		0.560	20.1	0.1×10^{-3}	0.48	3.17	49.45	295×10^{8}		
		0.577	19.9	0.203×10^{-3}	0.465	3.01	47.01	167.5×10^{8}		
ZrO_2 8Y [67]	0.5	0.526	19.58	0.044×10^{-3}	0.416	2.41	34.82	1278×10^{8}	16.42	16.98
		0.543	23.44	0.138×10^{-3}	0.418	2.28	32.94	482.4×10^{8}		
		0.560	27.08	0.372×10^{-3}	0.458	2.25	32.73	220.5×10^{8}		
		0.577	22.78	0.638×10^{-3}	0.468	2.20	32.0	92.84×10^{8}		
		0.593	14.25	0.739×10^{-3}	0.493	2.17	31.5	36.7×10^{8}		
Al_2O_3 30ZrO_2 30$Al_{16}Si_2O_{13}$ [68]	0.4	0.723	36.19	0.152×10^{-3}	0.493	3.98	47.04	604.0×10^{8}	17.06	17.75
		0.745	33.86	0.871×10^{-3}	0.485	3.54	44.53	96.72×10^{8}		
		0.767	16.31	1.05×10^{-3}	0.468	2.16	28.95	27.9×10^{8}		
Al_2O_3 25$NiAl_2O_4$ 25ZrO_2 [69]	1.3	0.702	32.51	0.018×10^{-3}	0.61	3.34	38.18	5803×10^{8}	19.47	19.99
		0.713	30.46	0.031×10^{-3}	0.68	3.13	36.79	3120×10^{8}		
		0.723	30.2	0.206×10^{-3}	0.723	2.90	35.0	1380×10^{8}		
		0.734	33	0.883×10^{-3}	0.694	2.75	34.1	921×10^{8}		
		0.745	30.4	0.146×10^{-3}	0.67	2.64	33.6	483.5×10^{8}		
6061/20% SiC [70]	0.8	0.590	43.16	6.01×10^{-3}	0.53	5.80	50.9	23.93×10^{8}	12.75	13.36
		0.628	19.2	6.74×10^{-3}	0.502	3.72	25.3	9.5×10^{8}		
		0.643	10.59	8.17×10^{-3}	0.498	3.56	18.75	4.32×10^{8}		
7075/20% SiC [71]	5	0.596	42.53	0.873×10^{-3}	0.473	5.42	56.0	200×10^{8}	13.76	14.41
		0.612	26.61	0.543×10^{-3}	0.481	3.14	27.44	168×10^{8}		
		0.627	15.58	0.683×10^{-3}	0.505	2.52	18.63	73×10^{8}		
Bulk Metallic Glasses										
Zr_{65} Al_{10} Ni_{10} Cu_{15} [72]	~10	0.587	138.7	0.44×10^{-3}	0.50	3.09	169.8	851.2×10^{8}	15.25	15.85
		0.605	75.57	3.01×10^{-3}	0.73	2.51	98.83	72.6×10^{8}		
		0.623	56.94	11.1×10^{-3}	0.72	2.43	68.68	15.9×10^{8}		
		0.641	39.40	64.0×10^{-3}	0.69	2.29	45.53	1.92×10^{8}		
$Zr_{52.5}Al_{10}Cu_{22}Ti_{2.5}Ni_{13}$ [73]	~10	0.621	251.3	0.61×10^{-3}	0.55	3.86	256.0	1353×10^{8}	14.19	14.82
		0.630	119.0	0.75×10^{-3}	0.58	3.20	123.2	523.7×10^{8}		
		0.639	46.28	0.97×10^{-3}	0.603	2.21	49.4	160×10^{8}		

$La_{55}Al_{25}Ni_{20}$ [35]	~10	0.687	49.04	4.85×10^{-3}	0.48	3.72	136.1	9.1×10^{8}	15.29	16.0
		0.701	32.35	21.84×10^{-3}	0.55	2.80	60.53	2.85×10^{8}		
		0.716	21.95	67.71×10^{-3}	0.59	2.25	28.75	0.89×10^{8}		
		0.730	13.98	106.3×10^{-3}	0.65	2.01	15.1	0.42×10^{8}		
$La_{60}Al_{20}Ni_{10}Co_5Cu_5$ [74]	~10	0.713	4.69	0.784×10^{-3}	0.71	5.15	7.03	16.32×10^{8}	16.43	17.18
		0.744	4.24	2.24×10^{-3}	0.82	4.20	6.18	6.0×10^{8}		
		0.775	3.60	5.23×10^{-3}	0.734	3.42	5.42	2.09×10^{8}		
		0.806	4.11	22.96×10^{-3}	0.76	2.47	4.20	0.6×10^{8}		
$Pd_{40}Ni_{40}P_{20}$ [75]	~10	0.566	70.15	5.9×10^{-3}	0.817	6.30	124.3	31.15×10^{8}	13.39	13.97
		0.575	61.97	17.07×10^{-3}	0.797	4.95	85.90	11.13×10^{8}		
		0.585	28.94	50.4×10^{-3}	0.813	3.70	56.48	1.75×10^{8}		
		0.594	14.79	144.6×10^{-3}	0.623	3.05	41.18	0.2×10^{8}		
$Fe_{72}Hf_8Nb_2B_{18}$ [76]	~10	0.694	289.0	2.32×10^{-3}	0.354	3.32	533.5	72.65×10^{8}	14.77	15.48
		0.702	284.4	10.07×10^{-3}	0.492	2.80	376.6	70.20×10^{8}		
		0.710	140.5	8.0×10^{-3}	0.583	2.22	250.0	38.27×10^{8}		
$Mg_{65}Cu_{25}Y_{10}$ [77]	~10	0.593	16.08	2.69×10^{-3}	0.492	5.45	34.0	22.8×10^{8}	13.14	13.74
		0.600	11.97	5.38×10^{-3}	0.496	2.64	15.23	8.03×10^{8}		
		0.607	8.71	5.77×10^{-3}	0.493	2.42	12.9	4.88×10^{8}		
Geological Materials & Ice										
Olivine [78]	5.4	0.655	294.4	0.0048×10^{-3}	0.292	6.57	360.0	1200×10^{10}	19.32	19.99
		0.678	243.3	0.0186×10^{-3}	0.357	5.23	260.3	385×10^{10}		
		0.701	178.9	0.0375×10^{-3}	0.551	4.61	208.4	139×10^{10}		
Limestone [79]	4.2	0.604	105.5	0.0135×10^{-3}	0.21	4.76	118.9	166×10^{10}	15.19	15.86
		0.666	40.66	0.0422×10^{-3}	0.377	2.35	56.05	18.8×10^{10}		
		0.728	26.37	0.175×10^{-3}	0.526	2.20	50.0	2.64×10^{10}		
Anorthite-Diopside, dry [80]	3.1	0.726	86.84	0.0018×10^{-3}	0.562	4.48	151.4	560×10^{10}	18.97	19.68
		0.753	78.38	0.0192×10^{-3}	0.558	3.8	81.0	136×10^{10}		
		0.781	38.67	0.036×10^{-3}	0.70	3.61	50.95	37.4×10^{10}		
Anorthite-Diopside, wet [80]	3.1	0.671	92.95	0.002×10^{-3}	0.552	6.45	176.0	1290×10^{10}	18.71	19.43
		0.699	108.2	0.009×10^{-3}	0.62	5.04	137.5	389×10^{10}		
		0.726	102.1	0.0284×10^{-3}	0.60	4.8	131.0	98.1×10^{10}		
		0.753	31.01	0.0295×10^{-3}	0.608	3.01	82.2	20.1×10^{10}		
Ice [81]	10	0.465	4.59	0.0001×10^{-3}	0.262	6.49	7.32	464×10^{10}	12.94	13.83
		0.507	2.88	0.00027×10^{-3}	0.253	5.0	4.60	51.8×10^{10}		
		0.529	1.76	0.00012×10^{-3}	0.284	4.26	3.27	39.0×10^{10}		
Ice [82]	1700	0.510	0.457	0.182×10^{-8}	0.409	5.1	0.675	4730×10^{10}	15.11	16.03
		0.541	0.404	0.84×10^{-8}	0.35	3.9	0.504	1160×10^{10}		
		0.556	0.387	1.94×10^{-8}	0.366	3.27	0.412	580×10^{10}		
Nanostructured Materials										
Si_3N_4 [83]	0.07	0.793	161.5	0.0943×10^{-3}	0.568	3.67	185.1	57.6×10^{10}	16.89	17.72
		0.816	110.5	0.208×10^{-3}	0.592	3.37	121.9	17.8×10^{10}		
		0.839	65.58	0.342×10^{-3}	0.653	3.04	79.01	6.55×10^{10}		
		0.862	31.69	0.475×10^{-3}	0.75	2.16	40.27	2.25×10^{10}		
TiAl [84]	0.04	0.597	126.3	0.0524×10^{-3}	0.175	4.22	142.5	45.62×10^{10}	15.03	15.66
		0.641	87.52	0.134×10^{-3}	0.16	3.75	112.7	11.98×10^{10}		
		0.685	36.27	0.057×10^{-3}	0.161	3.14	83.99	9.07×10^{10}		
		0.714	23.20	0.0594×10^{-3}	0.212	2.65	63.09	5.05×10^{10}		
Ni-Co [85]	0.02	0.414	25.12	2.42×10^{-3}	0.49	4.75	34.32	30.45×10^{8}	14.30	14.88
		0.442	22.28	2.52×10^{-3}	0.55	4.42	29.10	21.55×10^{8}		
		0.471	18.10	2.80×10^{-3}	0.32	3.92	23.50	8.70×10^{8}		
Zirconi a-Alumina [86]	0.06	0.584	48.58	0.603×10^{-3}	0.50	4.03	126.2	135.02×10^{8}	13.42	14.04
		0.602	51.37	2.11×10^{-3}	0.516	3.45	80.36	60.61×10^{8}		
		0.620	41.44	5.27×10^{-3}	0.484	3.17	54.91	21.42×10^{8}		
		0.635	24.41	5.62×10^{-3}	0.476	2.72	35.09	12.02×10^{8}		
Zirconi a-Spinel [86]	0.05	0.574	79.57	0.530×10^{-3}	0.478	5.73	106.2	403.9×10^{8}	13.47	14.07
		0.592	49.67	0.81×10^{-3}	0.508	3.92	72.66	140.9×10^{8}		
		0.610	42.0	1.20×10^{-3}	0.482	2.83	52.53	65.3×10^{8}		
		0.629	30.46	3.11×10^{-3}	0.486	2.41	44.75	21.63×10^{8}		

$\nu = kT/h$ is used for the present calculations and it has already been shown that the values obtained by this substitution are very close those arrived at using $\nu = 10^{13}\ s^{-1}$ [21].

Appendix S. A

The need and meaning of terms σ^*, p_0 *and* σ_c

Based on the concept of thermally activated flow commonly used to explain high temperature deformation (see, for a summary, [11,12,37]), it is known that the stress exponent, n, or its inverse, m, the strain-rate sensitivity index, is a function of stress, temperature and grain size. For isothermal condition and a constant microstructure, n or m is a function of stress (although within narrow ranges of stress/strain rate it is assumed to be a constant). When the real activation energy for the rate controlling process is to be determined, the strain rate should be measured at 3 or more temperatures keeping σ^n (see Eq. (1)) constant [87]. *Then, as n varies with temperature, dimensional consistency can be ensured only when σ is made dimensionless.* To overcome this problem, some researchers divide the log (strain rate) - log (stress) range into a few linear sub-domains within which n is nearly constant so that the real activation energy can be obtained by simply keeping σ constant at different temperatures and suggest that different rate controlling processes are present in each of the sub-domains, even when microstructural and topological evidence does not warrant such a conclusion. In addition, as can be readily appreciated, such an approach increases the number of mechanisms needed to explain a set of experimental results. There are also other problems associated with that kind of an approach and these are summarized in [37].

For mathematical convenience, the stress is expressed in units of $(e\sigma_c)$ with e the base of natural logarithms, i. e. ([12, 37]), where σ_c is the stress at which $m=1$ in a normalized $(\dot{\varepsilon}^*=|\dot{\varepsilon}|)-(\sigma^*)$ space ("ideal" superplastic deformation, where Newtonian viscosity would be present) and the range of interest in σ^* will therefore be ≈ 0 to $(1/e)$. For simplifying the equations, a term p equal to $(n-1)$ is introduced. p_0 is the value of p as the stress tends to zero.

Appendix S. B

Calculation procedure for determining the parameters of interest.

The detailed procedure for the calculations, including the derivations, are given in [12, 37]. A summary is given here.

Digitalize the data from log (stress, σ) - log (strain rate, $\dot{\varepsilon}$) experimental curves at different test temperatures for the material concerned. Data pertaining to a minimum of three different temperatures are required. (If data are available for more than 3 temperatures, it is welcome.) Consider any isothermal sigmoidal log (stress) - log (strain rate) plot. Fit a 3rd order polynomial curve (in contrast, Mulholland et al. [88] have fitted a fourth degree curve, which reduces the degree of freedom; in our case, even with a third degree fit we get a correlation coefficient, $R^2=0.95$ or more) and calculate the instantaneous slope (m value) for the entire range of strain rate. Find out the point of inflection and determine m_{max}, σ_{opt}, $\dot{\varepsilon}_{opt}$, T_{hom} and $\eta_{app}=(3\sigma/\dot{\varepsilon})$ using the procedures and equations given in the main text. Repeat it for different test temperatures. Now, consider log (stress, σ) - log (strain rate, $\dot{\varepsilon}$) data points from the lowest strain rate to the point of inflection (the optimal range) for every test temperature. Fit a second order polynomial curve to the data set obtained and compute $n=1/m$ and $p=(n-1)$. Compute for every material σ_{ci} and p_{0i} values for different temperatures (T_i) by solving Eq. (2) simultaneously using the method of least of squares and the two constraints given below that equation.

Calculate the σ_i values for each test temperature (T_i) such that $[2p_0+(1+p_0)\ln(\sigma/e\sigma_c)-(p_0\sigma/\sigma_c)]$ is kept constant. Plot $\ln\dot{\varepsilon}$ vs. $(1/T)$ and determine the slope which is equal to $(-Q/k)$ for $\nu=(kT/h)$ and calculate (Q/kT_m). Satisfy that this value is (nearly) material-independent, in addition to being independent of the stress values at which it is computed. Compute $\dot{\varepsilon}_i$ corresponding to σ_i from the 3rd order polynomial equation for a given temperature and calculate the $\ln(A_3)$ value from Eq. (3a) corresponding to $\nu=(kT/h)$. Compute $\dot{\varepsilon}_c$ corresponding to the σ_c value from Eq. (3a) and compute $\eta_{abs}=\sigma_c/3\dot{\varepsilon}_c$. Normalize the variables as $(\sigma/\sigma_{opt}$, $\dot{\varepsilon}/\dot{\varepsilon}_{opt}$, m/m_{max} and $\eta_{app}/\eta_{abs})$.

Appendix S. C

Calculation of R^2 *value (coefficient of determination/correlation)*

It should be noted that there are 8 different ways of defining R^2 and one has to choose the appropriate way of defining R^2, which is problem-dependent [89]. In the present case, the problem is simple. We take a common, well-accepted phenomenological equation as the model and use it to fit the experimental data pertaining to superplastic materials of different classes and ascertain the closeness of fit in different ranges of the strain rate-stress-temperature normalized space. There is no need to choose between model equations, as discussed in [89], to decide on the better way of defining R^2, i. e. ours is a relatively simple problem.

For our purpose, we calculated the R^2 value using the definition given below,

Coefficient of determination or correlation, $R^2=1-(y_{true}-y_{pred})/(y_{true}-\overline{y})$

where, y_{true} is obtained from the experiments, y_{pred} is calculated from the model and $\overline{y}$ is the mean experimental value.

It is also noted that the closeness of fit between the experimental data and the model equation is verified in the different regions of stress-strain rate-temperature normalized space with respect to only this well-defined, oft-used statistical parameter.

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