# Correlating Critical Behaviour and Magnetocaloric Effect in *Fe-Hf-Zr-B-Cu* Metallic Glasses

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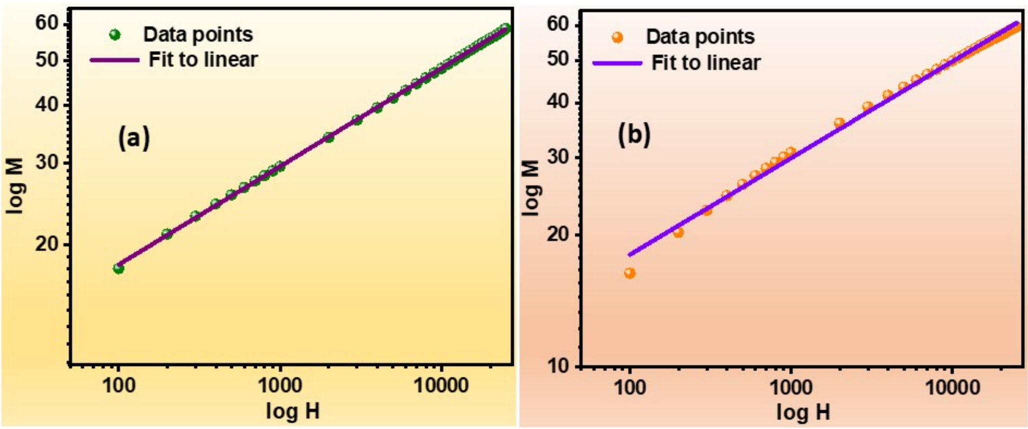


**Fig.S1.** log M versus log H graph of**(a)** $Fe_{86}Hf_2Zr_7B_4Cu_1$ ribbons at T=298 K and **(b)** $Fe_{84}Hf_4Zr_7B_4Cu_1$ ribbons at T=312 K ribbons.

**Table S1.** Comparison of Magnetocaloric Properties of Fe-Based Alloys

| **Compositions** | $T_C$ **(K)** | $-\Delta S_M$ **(J/kgK)** | *RCP* **(J/kg)** | **References** |
|---|---|---|---|---|
| $Fe_{86}Hf_2Zr_7B_4Cu_1$ | 298 | 1.94 (2.5 T) | 61.23 | Present work |
| $Fe_{84}Hf_4Zr_7B_4Cu_1$ | 312 | 1.65 (2.5 T) | 33.00 | Present work |
| $Fe_{86}Zr_8B_5Cu_1$ | 320 | 2.01 (2.5 T) | 53.74 | [1] |
| $Fe_{84}Zr_9B_6Cu_1$ | 328 | 1.81 (2.5 T) | 38.76 | [1] |
| $Fe_{82}Zr_{10}B_7Cu_1$ | 339 | 1.68 (2.5 T) | 49.78 | [1] |
| $Fe_{84}Zr_6B_{10}$ | 427 | 1.22 (1.4 T) | 59 | [2] |
| $Fe_{82}Ni_2Zr_6B_{10}$ | 465 | 1.38 (1.4 T) | 58 | [2] |
| $Fe_{80}Ni_4Zr_6B_{10}$ | 473 | 1.45 (1.4 T) | 63 | [2] |
| $Fe_{78}Ni_6Zr_6B_{10}$ | 482 | 1.52 (1.4 T) | 69 | [2] |

**Table S2.** Summary of Percentage Deviations of Experimental Critical Exponents from Theoretical Models.

| **Composition** | **Technique** | **Theory** | **β_dev(%)** | **γ_dev(%)** | **RMS_dev(%)** |
|---|---|---|---|---|---|
| $Fe_{86}Hf_2Zr_7B_4Cu_1$ | Modified Arrott | 3D Heisenberg | 12.329 | 10.479 | **11.441** |
| $Fe_{86}Hf_2Zr_7B_4Cu_1$ | Modified Arrott | 3D Ising | 26.154 | 3.548 | 18.663 |
| $Fe_{86}Hf_2Zr_7B_4Cu_1$ | Modified Arrott | 3 XY | 18.841 | 9.119 | 14.801 |
| $Fe_{86}Hf_2Zr_7B_4Cu_1$ | Kouvel-Fisher | 3D Heisenberg | 31.781 | 12.275 | **24.091** |
| $Fe_{86}Hf_2Zr_7B_4Cu_1$ | Kouvel-Fisher | 3D Ising | 48.000 | 5.484 | 34.162 |
| $Fe_{86}Hf_2Zr_7B_4Cu_1$ | Kouvel-Fisher | 3 XY | 39.420 | 10.942 | 28.928 |
| $Fe_{84}Hf_4Zr_7B_4Cu_1$ | Modified Arrott | 3D Heisenberg | 41.644 | 25.000 | **34.345** |
| $Fe_{84}Hf_4Zr_7B_4Cu_1$ | Modified Arrott | 3D Ising | 59.077 | 19.194 | 43.923 |
| $Fe_{84}Hf_4Zr_7B_4Cu_1$ | Modified Arrott | 3 XY | 49.855 | 23.860 | 39.082 |
| $Fe_{84}Hf_4Zr_7B_4Cu_1$ | Kouvel-Fisher | 3D Heisenberg | 73.151 | 18.338 | **53.326** |
| $Fe_{84}Hf_4Zr_7B_4Cu_1$ | Kouvel-Fisher | 3D Ising | 94.462 | 12.016 | 67.333 |
| $Fe_{84}Hf_4Zr_7B_4Cu_1$ | Kouvel-Fisher | 3 XY | 83.188 | 17.097 | 60.053 |

## References


[1] A. Vinod *et al.*, “Glass forming ability and critical exponents in Hf-Modified Fe-Zr-B-Cu amorphous alloys for near room temperature magnetocaloric application,” *Sci. Rep.*, vol. 15, no. 1, p. 24223, Jul. 2025, doi: 10.1038/s41598-025-08371-x.

[2] B. Podmiljsak, J. H. Kim, P. J. McGuiness, and S. Kobe, “Influence of Ni on the magnetocaloric effect in Nanoperm-type soft-magnetic amorphous alloys,” *J. Alloys Compd.*, vol. 591, pp. 29–33, 2014, doi: 10.1016/j.jallcom.2013.12.150.