

# Machine-Learning-Driven Design of High-Elastocaloric NiTi-Based Shape Memory Alloys

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**Table S1.** List of features used in M2 and M3. Pink represents the remaining features after filtering by Pearson correlation coefficient.

Abbreviation	Description
dor	Waber–Cromer's pseudopotential radius [49]
en	Electronegativity (Pauling) [50]
mr	Metallic radius [51]
ar	Atomic radius [52]
aw	Atomic weight (Villars, Daams)
val	Valence
rcov	Radii: covalent
wf	Work function
E0	Energy per atom of T=0K ground state
La	Lattice constants a
Ven	Valence electron number [53]
mc	Modulus compression
An	Atomic number
MN	Mendeleev number
eif	Energy ionization first
dve	Distance valence electron (Schubert)
Ns	NsValence
rsh	Radii ionic (Shannon)
n_ws	Electron density at surface of Wigner–Sietz cell
EN	Type of element
<i>HT</i> <sub>I</sub>	Temperature of homogenization treatment
<i>Ht</i> <sub>I</sub>	Time of homogenization treatment
<i>W</i> <sub>I</sub>	Ways of quenching of homogenization treatment
<i>HT</i> <sub>II</sub>	Temperature of solution treatment
<i>Ht</i> <sub>II</sub>	Time of solution treatment
<i>W</i> <sub>II</sub>	Ways of quenching of solution treatment
<i>HT</i> <sub>III</sub>	Temperature of aging treatment

$Ht_{III}$	Time of aging treatment
$W_{III}$	Ways of quenching of aging treatment

**Table S2.** Thirteen features after Pearson correlation selection for M1.

Abbreviation	Description
n_ws	Electron density at surface of Wigner–Sietz cell
aven	Average electron number
en	Electronegativity (Alfred-Rochow)
dve	Distance valence electron (Schubert)
Ns	NsValence
ar	Atomic radius
E0	Energy per atom of T=0K
rsh	Radii ionic (Shannon)
GS	GSmagmom
LA	Lattice angle
mc	Modulus compression
La	Lattice constants a
wf	Work function

## References

49. Waber, J.; Cromer, D.T. Orbital radii of atoms and ions. *J. Chem. Phys.* **1965**, *42*, 4116–4123.
50. Pauling, L. The nature of the chemical bond. IV. The energy of single bonds and the relative electronegativity of atoms. *J. Am. Chem. Soc.* **1932**, *54*, 3570–3582.
51. Rabe, K.M.; Phillips, J.C.; Villars, P.; Brown, I.D. Global multinary structural chemistry of stable quasicrystals, high-TC ferroelectrics, and high-Tc superconductors. *Phys. Rev. B* **1992**, *45*, 7650–7676.
52. Clementi, E.; Raimondi, D.L. Atomic screening constants from SCF functions. *J. Chem. Phys.* **1963**, *38*, 2686–2689.
53. Pettifor, D.G.; Pettifor, D. Bonding and Structure of Molecules and Solids; Clarendon Press Oxford: Oxford, UK, 1995.

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