

Figure S1. The calculated P - V - T data of iron alloys with fitted EoS. Filled red circles represent the data used for EoS analysis.

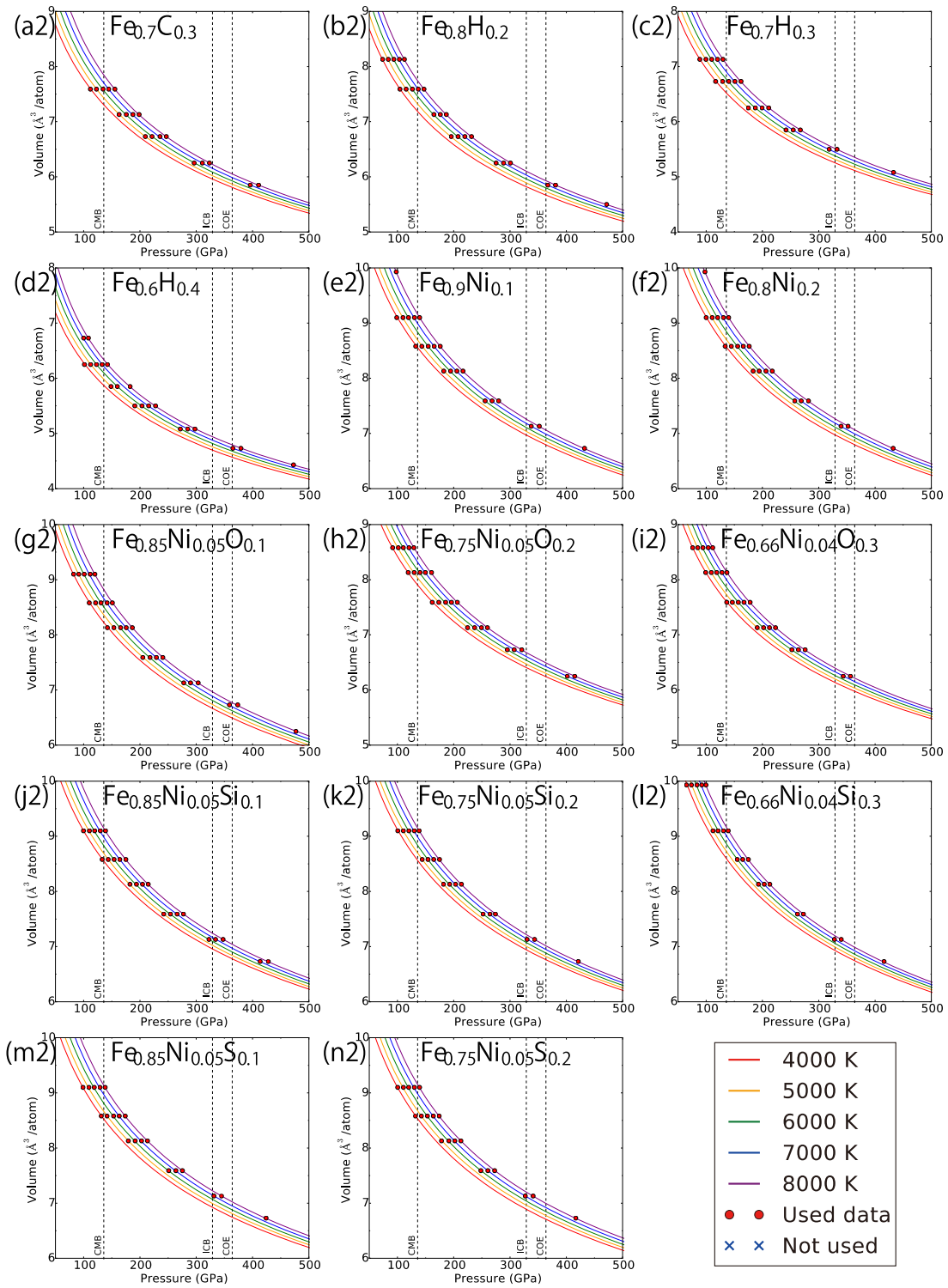


Figure S1. (Continued).

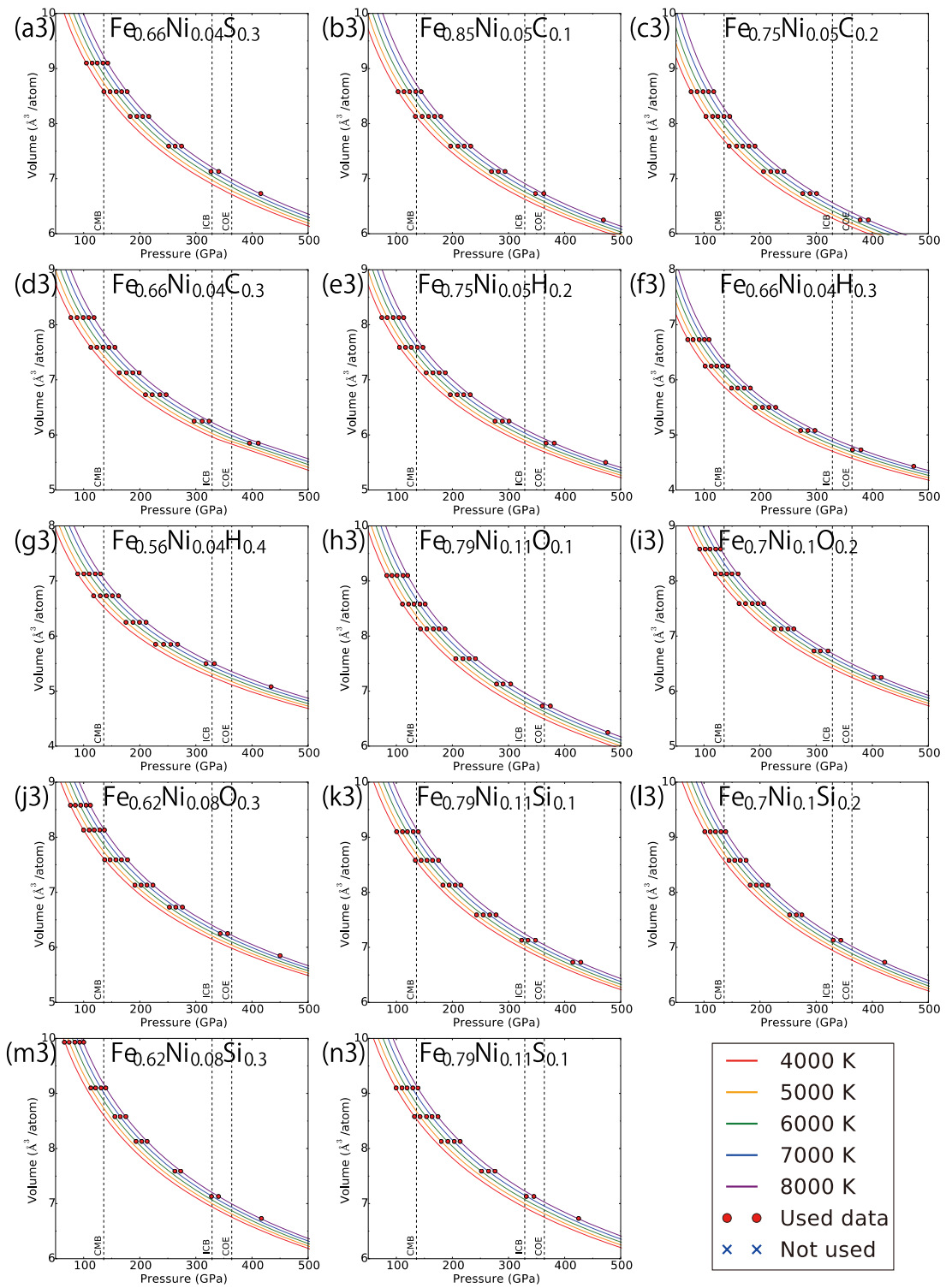


Figure S1. (Continued).

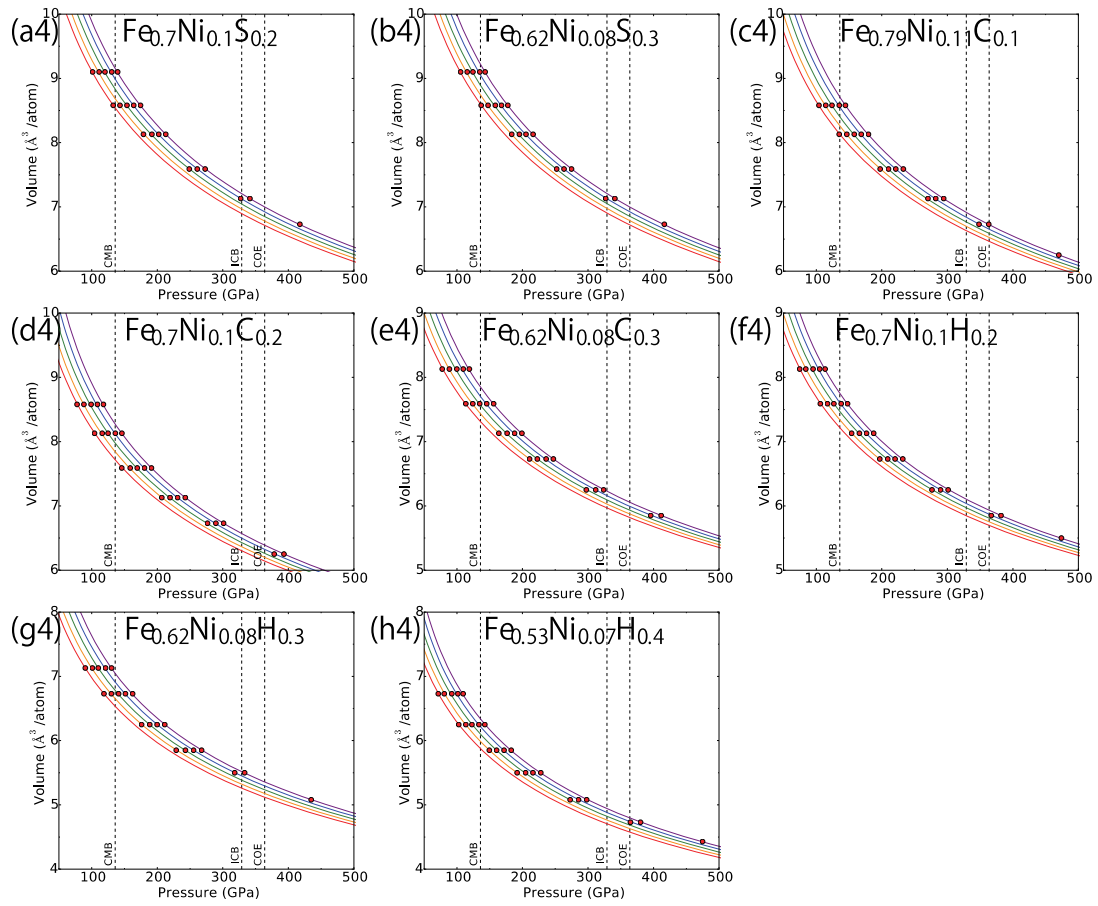


Figure S1. (Continued).

Table S1. EoS parameters for the best-fit composition models.

$T_{ICB} = 5000 \text{ K}$								
EoS parameter	Fe ₁₀₀	Fe _{0.78} O _{0.22}	Fe _{0.85} Si _{0.15}	Fe _{0.81} S _{0.19}	Fe _{0.80} C _{0.20}	Fe _{0.70} H _{0.30}	Fe _{0.73} Ni _{0.05} O _{0.22}	Fe _{0.80} Ni _{0.05} Si _{0.15}
V_0 ($10^{-5}\text{m}^3/\text{mol}$)	1.20(1)	1.51(1)	1.39(1)	1.39(1)	1.20(1)	1.51(1)	1.51(1)	1.39(1)
K_{T0} (GPa)	15.68(1)	2.92(1)	7.08(1)	7.59(1)	8.34(1)	1.37(1)	3.00(1)	7.27(1)
$K_{T0'}$	6.86(1)	8.02(1)	7.47(1)	7.30(1)	7.46(1)	8.27(1)	7.97(1)	7.41(1)
γ (fixed)	1.5	1.5	1.45	1.5	1.45	1.4	1.5	1.45
e_0 (J/mol)	0.390(1)	0.222(1)	0.283(1)	0.154(1)	0.187(1)	0.051(1)	0.146(1)	0.261(1)
g	-0.070(1)	-0.139(1)	-0.214(1)	-0.835(1)	-0.613(1)	-1.086(1)	-0.543(1)	-0.295(1)
$T_{ICB} = 6500 \text{ K}$								
EoS parameter		Fe _{0.82} O _{0.18}	Fe _{0.88} Si _{0.12}	Fe _{0.85} S _{0.15}	Fe _{0.84} C _{0.16}	Fe _{0.74} H _{0.26}	Fe _{0.77} Ni _{0.05} O _{0.18}	Fe _{0.82} Ni _{0.05} Si _{0.13}
V_0 ($10^{-5}\text{m}^3/\text{mol}$)		1.51(1)	1.39(1)	1.39(1)	1.20(1)	1.35(1)	1.51(1)	1.39(1)
K_{T0} (GPa)		3.17(1)	7.11(1)	7.43(1)	9.33(1)	2.48(1)	3.20(1)	7.15(1)
$K_{T0'}$		7.98(1)	7.47(1)	7.34(1)	7.37(1)	8.09(1)	7.96(1)	7.46(1)
γ (fixed)		1.5	1.45	1.5	1.45	1.4	1.5	1.45
e_0 (J/mol)		0.265(1)	0.308(1)	0.153(1)	0.231(1)	0.065(1)	0.172(1)	0.286(1)
g		-0.092(1)	-0.190(1)	-0.836(1)	-0.366(1)	-1.049(1)	-0.496(1)	-0.269(1)

Table S1. (Continued).

$T_{ICB} = 5000 \text{ K}$								
EoS parameter	Fe _{0.76} Ni _{0.05} S _{0.19}	Fe _{0.75} Ni _{0.05} C _{0.20}	Fe _{0.64} Ni _{0.04} H _{0.32}	Fe _{0.69} Ni _{0.09} O _{0.22}	Fe _{0.74} Ni _{0.10} Si _{0.16}	Fe _{0.71} Ni _{0.10} S _{0.19}	Fe _{0.7} Ni _{0.09} C _{0.21}	Fe _{0.6} Ni _{0.08} H _{0.32}
V_0 ($10^{-5}\text{m}^3/\text{mol}$)	1.81(1)	1.20(1)	1.36(1)	1.51(1)	1.39(1)	1.39(1)	1.20(1)	1.36(1)
K_{T0} (GPa)	1.70(1)	8.49(1)	2.00(1)	3.07(1)	7.38(1)	7.82(1)	8.42(1)	2.00(1)
$K_{T0'}$	8.38(1)	7.42(1)	8.08(1)	7.93(1)	7.38(1)	7.24(1)	7.44(1)	8.08(1)
γ (fixed)	1.5	1.45	1.4	1.5	1.45	1.5	1.45	1.4
e_0 (J/mol)	0.168(1)	0.216(1)	0.068(1)	0.139(1)	0.263(1)	0.194(1)	0.191(1)	0.066(1)
g	-0.547(1)	-0.488(1)	-0.786(1)	-0.559(1)	-0.294(1)	-0.547(1)	-0.526(1)	-0.786(1)
$T_{ICB} = 6500 \text{ K}$								
EoS parameter	Fe _{0.79} Ni _{0.05} S _{0.16}	Fe _{0.78} Ni _{0.05} C _{0.17}	Fe _{0.69} Ni _{0.04} H _{0.27}	Fe _{0.71} Ni _{0.1} O _{0.19}	Fe _{0.77} Ni _{0.1} Si _{0.13}	Fe _{0.74} Ni _{0.1} S _{0.16}	Fe _{0.72} Ni _{0.1} C _{0.18}	Fe _{0.64} Ni _{0.09} H _{0.27}
V_0 ($10^{-5}\text{m}^3/\text{mol}$)	1.81(1)	1.20(1)	1.36(1)	1.51(1)	1.39(1)	1.39(1)	1.20(1)	1.36(1)
K_{T0} (GPa)	1.70(1)	9.33(1)	2.48(1)	3.03(1)	7.38(1)	7.82(1)	8.42(1)	2.48(1)
$K_{T0'}$	8.38(1)	7.37(1)	8.09(1)	8.01(1)	7.38(1)	7.24(1)	7.44(1)	8.09(1)
γ (fixed)	1.5	1.45	1.4	1.5	1.45	1.5	1.45	1.4
e_0 (J/mol)	0.168(1)	0.230(1)	0.065(1)	0.290(1)	0.263(1)	0.194(1)	0.191(1)	0.065(1)
g	-0.547(1)	-0.366(1)	-1.049(1)	-0.068(1)	-0.294(1)	-0.547(1)	-0.526(1)	-1.049(1)