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Least Squares Twin Support Vector Machines to Classify End-Point Phosphorus Content in BOF Steelmaking—Supplementary Materials

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Table S1. List of candidate models to predict dephosphorization in steel.

Model	Equation
[M1] [1,2]	$\widehat{l_p} = 0.06[(\%CaO) + 0.37(\%MgO) + 4.65(\%P_2O_5) - 0.05(\%Al_2O_3) - 0.2(\%SiO_2)] - 10.52 + 2.5\log(\%Fe.total) + \frac{11570}{Temp}$
[M2] [1,2]	$\widehat{l_p} = 0.0680[(\%CaO) + 0.42(\%MgO) + 1.16(\%P_2O_5) + 0.2(\%MnO)] + \frac{11570}{Temp} - 10.52 + 2.5\log(\%Fe.total)$
[M3] [3]	$\widehat{l_p} = 0.07(\%CaO) + 0.031(\%MgO) + 0.31(\%Al_2O_3) + 0.02(\%MnO) + \frac{10911}{Temp} - 11.4 + 2.84\log(\%Fe.total)$
[M4] [3]	$\widehat{l_p} = 0.026(\%CaO) + 0.092(\%MgO) + 0.08(\%Al_2O_3) + 0.04(\%MnO) + \frac{12217}{Temp} - 6.29 + 0.35\log(\%Fe.total)$
[M5] [3]	$\widehat{l_p} = 0.075(\%CaO) + 0.025(\%MgO) + 0.3(\%Al_2O_3) + 0.14(\%MnO) + \frac{6042}{Temp} - 10.27 + 3.5\log(\%Fe.total)$
[M6] [4]	$\widehat{l_p} = 0.431[(\%CaO)/(\%SiO_2)] - 0.361\log(\%MgO) + \frac{13590}{Temp} - 5.71 + 0.384\log(\%Fe.total)$
[M7] [5]	$\widehat{l_p} = 0.072[(\%CaO) + 0.15(\%MgO) + 0.6(\%P_2O_5) + 0.6(\%MnO)] + \frac{11570}{Temp} - 10.50 + 2.5\log(\%Fe.total)$
[M8] [6]	$\widehat{l_p} = 5.89\log(\%CaO) + 0.5\log(\%P_2O_5) + 0.6(\%MnO) + \frac{15340}{Temp} - 18.542 + 2.5\log(\%Fe.total)$
[M9] [7]	$\widehat{l_p} = 0.056\log(\%CaO) + 0.5\log(\%P_2O_5) + \frac{12000}{Temp} - 10.42 + 2.5\log(\%Fe.total)$
[M10] [8]	$\widehat{l_p} = 5.6\log(\%CaO) + \frac{22350}{Temp} - 21.876 + 2.5\log(\%Fe.total)$
[M11] [9,10]	$\widehat{l_p} = 0.5\log(\%P_2O_5) + \frac{12625}{Temp} - 7.787 + 2.5\log(\%Fe.total)$
[M12] [11–13]	$\widehat{l_p} = 5.9\log(\%CaO) + 0.5\log(\%P_2O_5) - 0.00461Temp - 2.0845 + 2.5\log(\%Fe.total)$
[M13] [11–13]	$\widehat{l_p} = 5.39\log(\%CaO) + 0.5\log(\%P_2O_5) - 0.00447Temp - 3.0355 + 2.5\log(\%Fe.total)$
[M14] [4]	$\widehat{l_p} = 0.346[(\%CaO)/(\%SiO_2)] - 0.144\log(\%MgO) + \frac{10173}{Temp} - 5.41 + 0.855\log(\%Fe.total) + 0.0088\log(\%C)$
[M15] [14]	$\widehat{l_p} = 0.0023(\%CaO) - 0.0094(\%MgO) - 0.1910(\%C) + \frac{9736}{Temp} - 3.297 + 0.00053(\%Fe_tO)$
[M16] [14]	$\widehat{l_p} = 0.0066(\%CaO) - 0.0123(\%MgO) - 1.2270(\%C) + \frac{11913}{Temp} - 4.384 + 0.00426(\%Fe_tO)$
[M17] [15]	$\widehat{l_p} = 0.13(\%C) + \frac{20000}{Temp} - 12.24 + 2.5\log(\%Fe_tO) + 6.65\log\left(\frac{(\%CaO) + 0.8(\%MgO)}{(\%SiO_2) + (\%Al_2O_3) + 0.8(\%P_2O_5)}\right)$
[M18] [16,17]	$\widehat{l_p} = 0.0715[(\%CaO) + 0.25(\%MgO)] + \frac{7710.2}{Temp} - 8.55 + 2.5\log(\%Fe.total) + \left(\frac{105.1}{Temp} + .0723\right)(\%C)$
[M19] [4]	$\widehat{l_p} = \frac{13958}{Temp} - 7.9517 + 2.5\log(\%Fe_tO) - (\%Fe_tO)\big(0.0143 + 0.0001032(\%Fe_tO)\big) - 0.36$
[M20] [18]	$\widehat{l_p} = 3.52\log(\%CaO) + 2.5\log(\%FeO) + 0.5\log(\%P_2O_5) + \frac{4977}{Temp + 17.8} - 10.46$
[M21] [19,20]	$\widehat{l_p} = 1.53126\log(\%FeO) - 6.909 + \frac{12940}{Temp} + 33.23369\log(\%CaO) - 5.3505 + \log\left(\frac{1.6 + \sqrt{1.28 + (\%P) - 1.6(0.64 + (\%P))^{0.5}}}{1.82}\right) - \left(\frac{0.00129(\%Al_2O_3) + 0.00098(\%TiO_2) + 0.00026(\%V_2O_5)}{(\%SiO_2) + (\%Al_2O_3) + (\%V_2O_5) + (\%TiO_2)}\right)$

[M22] [4]	$\widehat{l_p} = 0.6639[(\%CaO)/(\%SiO_2)] + \frac{8198.1}{Temp} - 3.113 + 0.3956 \log(\%Fe.total) + 0.2075 \log(\%C)$
[M23] [21]	$\widehat{l_p} = 0.5[162(\%CaO) + 127.5(\%MgO) + 28.5(\%MnO)] + \frac{11000}{Temp} - 0.000628(SiO_2)^2 + 2.5 \log(\%FeO) - 10.76$
[M24] [22]	$\widehat{l_p} = 0.08(\%CaO) + 2.5 \log(\%Fe_tO) + \frac{22350}{Temp} - 16.0$
[M25] [22]	$\widehat{l_p} = 7 \log(\%CaO) + 2.5 \log(\%Fe_tO) + \frac{22350}{Temp} - 24.0$

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