Atomic Parameters

Quantities will be normalized vs hydrogen

```
hydrogenAtomicRadius = N[QuantityMagnitude[ElementData[1, "AtomicRadius"]]]
```

```
53.
```

```
hydrogenAtomicCrossSection = π * hydrogenAtomicRadius^2
```

```
8824.73
```

```
hydrogenAtomicVolume = 4 π / 3 * hydrogenAtomicRadius^3
```

```
623 615.
```

Grabbing all other quantities

```
atomicRadii =
  {#, N[QuantityMagnitude[ElementData[#, "AtomicRadius"]]]} & /@ {26, 14, 6, 13, 5, 15, 31, 32,
    29, 47, 79, 30, 22, 23, 24, 40, 41, 42, 72, 73, 74, 58, 59, 64, 92} (* In picometers *)
```

```
{{26, 156.}, {14, 111.}, {6, 67.}, {13, 118.}, {5, 87.}, {15, 98.}, {31, 136.},
 {32, 125.}, {29, 145.}, {47, 165.}, {79, 174.}, {30, 142.}, {22, 176.},
 {23, 171.}, {24, 166.}, {40, 206.}, {41, 198.}, {42, 190.}, {72, 208.},
 {73, 200.}, {74, 193.}, {58, QuantityMagnitude[Missing[NotAvailable]]},
 {59, 247.}, {64, 233.}, {92, QuantityMagnitude[Missing[NotAvailable]]}}
```

```
atomicRadii[[22, 2]] = 248.
```

```
248.
```

```
atomicRadii[[25, 2]] = 230.
```

```
230.
```

```
atomicCrossSection =
  {#[[1]], π * #[[2]]^2 / hydrogenAtomicCrossSection} & /@ atomicRadii (* In picometers squared *)
```

```
{{26, 8.66358}, {14, 4.38626}, {6, 1.59808}, {13, 4.95692}, {5, 2.69455},
 {15, 3.41901}, {31, 6.58455}, {32, 5.56248}, {29, 7.48487}, {47, 9.69206},
 {79, 10.7782}, {30, 7.17836}, {22, 11.0274}, {23, 10.4098}, {24, 9.8099},
 {40, 15.1072}, {41, 13.9566}, {42, 12.8515}, {72, 15.4019}, {73, 14.2399},
 {74, 13.2606}, {58, 21.8953}, {59, 21.7191}, {64, 19.3268}, {92, 18.8323}}
```

```
atomicVolumes = {#[[1]], (4π/3 * #[[2]]^3)/hydrogenAtomicVolume} & /@ atomicRadii (* In picometers cubed *)
```

```
{{26, 25.5004}, {14, 9.18631}, {6, 2.02021}, {13, 11.0362}, {5, 4.42313},
 {15, 6.32194}, {31, 16.8962}, {32, 13.1191}, {29, 20.4775}, {47, 30.1734},
 {79, 35.3851}, {30, 19.2326}, {22, 36.6193}, {23, 33.5862}, {24, 30.7253},
 {40, 58.7184}, {41, 52.1396}, {42, 46.0716}, {72, 60.4453}, {73, 53.7356},
 {74, 48.2886}, {58, 102.454}, {59, 101.219}, {64, 84.965}, {92, 81.7252}}
```

```
atomicMasses = {#, QuantityMagnitude[ElementData[#, "AtomicMass"]]} & /@ {26, 14, 6, 13, 5,
   15, 31, 32, 29, 47, 79, 30, 22, 23, 24, 40, 41, 42, 72, 73, 74, 58, 59, 64, 92} (* In amu *)
```

```
{{26, 55.845}, {14, 28.085}, {6, 12.011}, {13, 26.9815385}, {5, 10.81},
 {15, 30.973761998}, {31, 69.723}, {32, 72.630}, {29, 63.546}, {47, 107.8682},
 {79, 196.966569}, {30, 65.38}, {22, 47.867}, {23, 50.9415}, {24, 51.9961},
 {40, 91.224}, {41, 92.90637}, {42, 95.95}, {72, 178.49}, {73, 180.94788},
 {74, 183.84}, {58, 140.116}, {59, 140.90766}, {64, 157.25}, {92, 238.02891}}
```

```
atomicValenceElectrons =
 {#, Total[Take[Flatten[ElementData[#, "ElectronConfiguration"]], -2]]} & /@ {26, 14, 6,
   13, 5, 15, 31, 32, 29, 47, 79, 30, 22, 23, 24, 40, 41, 42, 72, 73, 74, 58, 59, 64, 92}
   (* Doesn't work for Cu, Ag, Au, Zn, but is okay with early transitions *)
```

```
{{26, 8}, {14, 4}, {6, 4}, {13, 3}, {5, 3}, {15, 5}, {31, 3}, {32, 4},
 {29, 11}, {47, 11}, {79, 11}, {30, 12}, {22, 4}, {23, 5}, {24, 6}, {40, 4},
 {41, 5}, {42, 6}, {72, 4}, {73, 5}, {74, 6}, {58, 3}, {59, 8}, {64, 3}, {92, 3}}
```

Data Processing

Import Database

```
rawData = Import["C:\\Users\\laris\\Documents\\MIT\\2018\\Summer\\Texas
    Research\\Final Data\\Database Curation\\CuratedDatabase7-26.csv"]
```

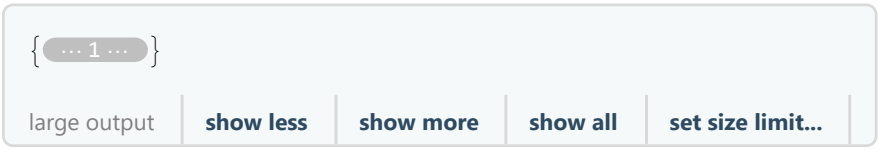
```
{ ··· 1 ··· }
large output | show less | show more | show all | set size limit...
```

```
rawLabels = rawData[[1, 1 ;; 33]]
```

```
{Fe, Si, C, Al, B, P, Ga, Ge, Cu, Ag, Au, Zn, Ti, V, Cr, Zr, Nb, Mo, Hf, Ta, W, Ce, Pr, Gd, U,
 Annealing temperature (K), Annealing Time (s), Primary Crystallization Onset (K),
 Primary Crystallization Peak (K), Secondary Crystallization Peak (K),
 Longitudinal Annealing field, Transverse Annealing field, Ribbon Thickness (um)}
```

Splitting Database into Columns

```
featureColumns = rawData[[2 ;; -1, #]] & /@ Range[1, Length[rawData[[1]]]]
```



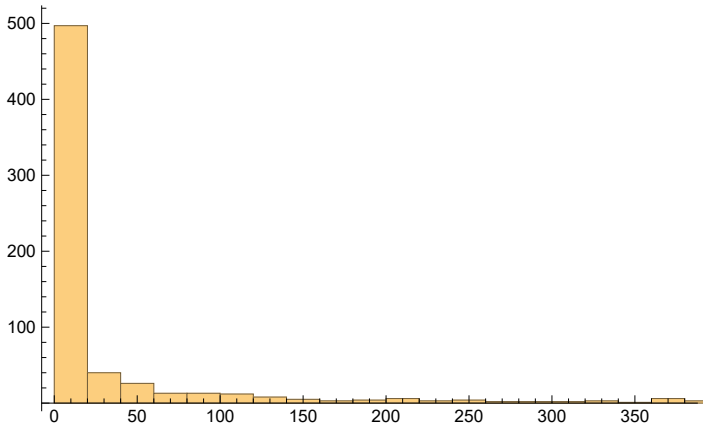
Raw Features

```
percentFe = featureColumns[[1]];
percentSi = featureColumns[[2]];
percentC = featureColumns[[3]];
percentAl = featureColumns[[4]];
percentB = featureColumns[[5]];
percentP = featureColumns[[6]];
percentGa = featureColumns[[7]];
percentGe = featureColumns[[8]];
percentCu = featureColumns[[9]];
percentAg = featureColumns[[10]];
percentAu = featureColumns[[11]];
percentZn = featureColumns[[12]];
percentTi = featureColumns[[13]];
percentV = featureColumns[[14]];
percentCr = featureColumns[[15]];
percentZr = featureColumns[[16]];
percentNb = featureColumns[[17]];
percentMo = featureColumns[[18]];
percentHf = featureColumns[[19]];
percentTa = featureColumns[[20]];
percentW = featureColumns[[21]];
percentCe = featureColumns[[22]];
percentPr = featureColumns[[23]];
percentGd = featureColumns[[24]];
percentU = featureColumns[[25]];
annealingTemp = featureColumns[[26]];
annealingTime = featureColumns[[27]];
primaryCrystalOnset = featureColumns[[28]];
primaryCrystalPeak = featureColumns[[29]];
secondaryCrystalPeak = featureColumns[[30]];
laField = featureColumns[[31]];
taField = featureColumns[[32]];
ribbonThickness = featureColumns[[33]];

rawFeatures = featureColumns[[1 ;; 33]];

earlyFeatures = {percentTi, percentV, percentCr, percentZr, percentNb, percentMo,
   percentHf, percentTa, percentW, percentCe, percentPr, percentGd, percentU};
lateFeatures = {percentCu, percentAg, percentAu, percentZn};
```

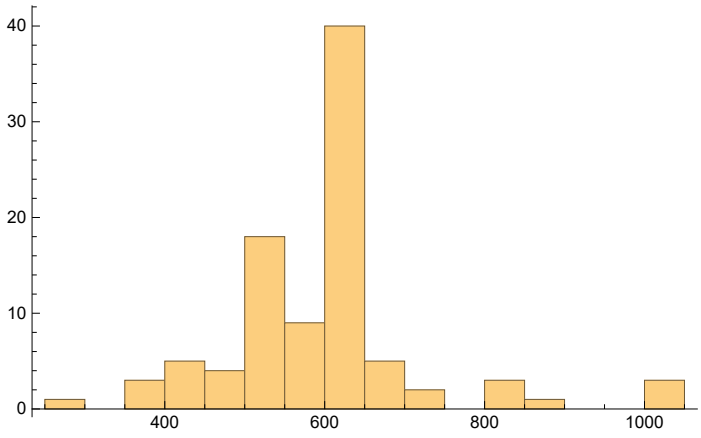
Values

```
coercivity = featureColumns[[34]];
curieTemp = featureColumns[[35]];
coreLoss = featureColumns[[36]];
electricalResistivity = featureColumns[[37]];
permeability = featureColumns[[38]];
magnetostriction = featureColumns[[39]];
magneticSaturation = featureColumns[[40]];
grainDiameter = featureColumns[[41]];
doi = featureColumns[[42]];
```

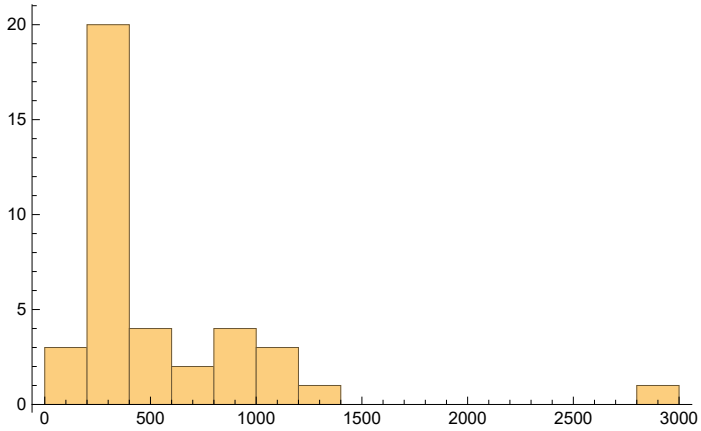
```
Histogram[coercivity]
```



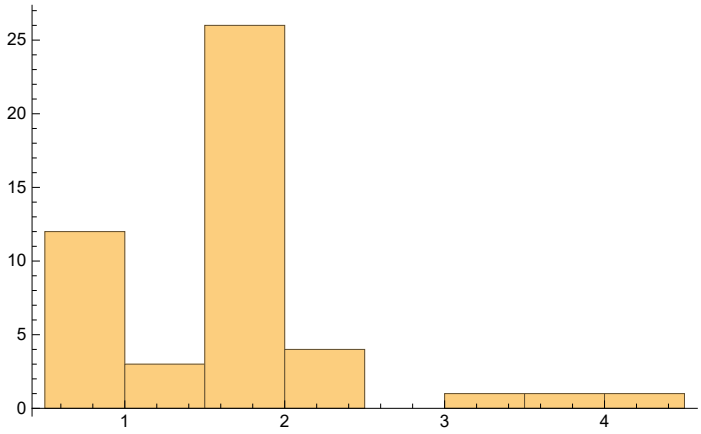

```
Histogram[curieTemp]
```



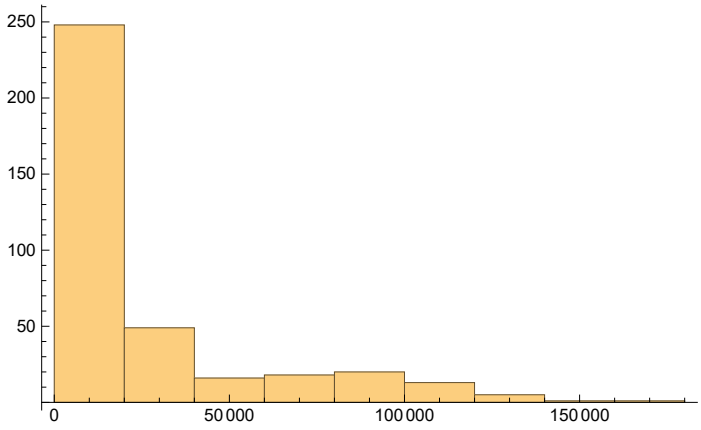
```
Histogram[coreLoss]
```



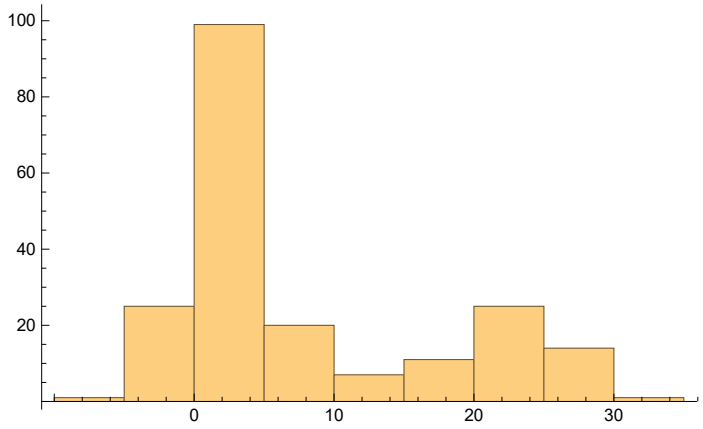

```
Histogram[electricalResistivity]
```



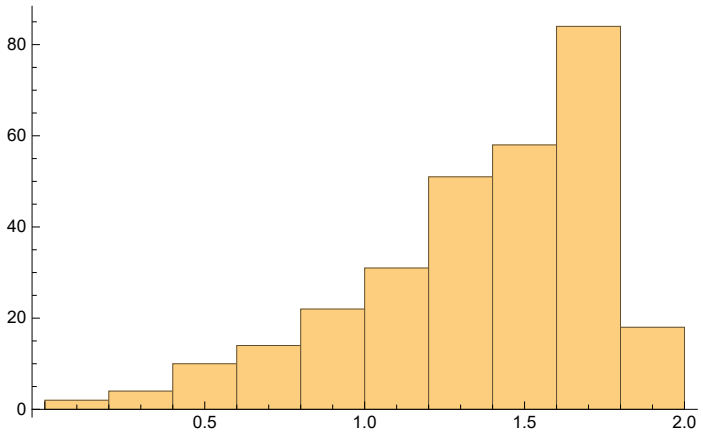

```
Histogram[permeability]
```



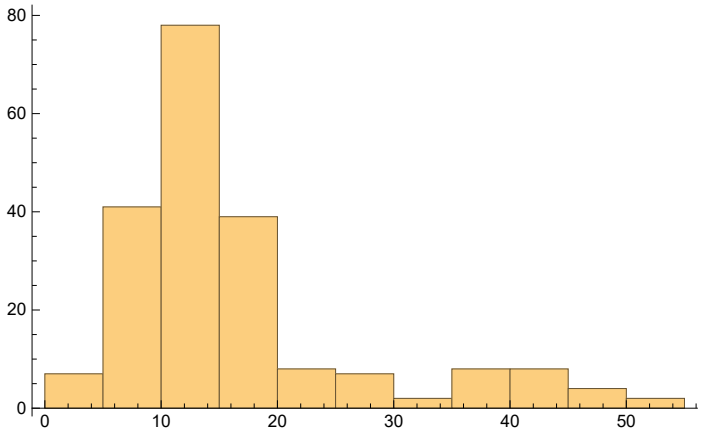
Histogram[magnetostriction]



Histogram[magneticSaturation]



Histogram[grainDiameter]



Simple Sum Transforms

```
percentSiCAl = Total[{percentSi, percentAl, percentC}, {1}];
(* Percent Si and Al and C combined *)
percentBP = Total[{percentB, percentP}, {1}] ;(* Percent B and P combined *)
percentGaGe = Total[{percentGa, percentGe}, {1}];(* Percent Ga and Ge combined *)

lateTransitionTotal = Total[lateFeatures, {1}];

earlyTransitionTotal = Total[earlyFeatures, {1}];
```

Simple Multiplication/Division Transforms

```
relativeToFeSiCAl = N[percentSiCAl[[#]] / percentFe[[#]]] & /@ Range[1, Length[percentFe]];
relativeToFeBP = N[percentBP[[#]] / percentFe[[#]]] & /@ Range[1, Length[percentFe]];
relativeToFeGaGe = N[percentGaGe[[#]] / percentFe[[#]]] & /@ Range[1, Length[percentFe]];
relativeToFeEarlyTransition =
  N[earlyTransitionTotal[[#]] / percentFe[[#]]] & /@ Range[1, Length[percentFe]];
relativeToFeLateTransition = N[lateTransitionTotal[[#]] / percentFe[[#]]] & /@
   Range[1, Length[percentFe]];

relativeToLateEarly = Quiet[N[earlyTransitionTotal[[#]] / lateTransitionTotal[[#]]] & /@
     Range[1, Length[lateTransitionTotal]]] /. {Indeterminate → "", ComplexInfinity → ""};

relativeToEarlySiCAl = Quiet[N[percentSiCAl[[#]] / earlyTransitionTotal[[#]]] & /@ Range[1,
      Length[earlyTransitionTotal]]] /. {Indeterminate → "", ComplexInfinity → ""};
relativeToLateSiCAl = Quiet[N[percentSiCAl[[#]] / lateTransitionTotal[[#]]] & /@
     Range[1, Length[lateTransitionTotal]]] /. {Indeterminate → "", ComplexInfinity → ""};

relativeToEarlyBP = Quiet[N[percentBP[[#]] / earlyTransitionTotal[[#]]] & /@ Range[1,
      Length[earlyTransitionTotal]]] /. {Indeterminate → "", ComplexInfinity → ""};
relativeToLateBP = Quiet[N[percentBP[[#]] / lateTransitionTotal[[#]]] & /@
     Range[1, Length[lateTransitionTotal]]] /. {Indeterminate → "", ComplexInfinity → ""};

relativeToEarlyGaGe = Quiet[N[percentGaGe[[#]] / earlyTransitionTotal[[#]]] & /@ Range[1,
      Length[earlyTransitionTotal]]] /. {Indeterminate → "", ComplexInfinity → ""};
relativeToLateGaGe = Quiet[N[percentGaGe[[#]] / lateTransitionTotal[[#]]] & /@
     Range[1, Length[lateTransitionTotal]]] /. {Indeterminate → "", ComplexInfinity → ""};
```

Weighted Average Transforms

Volume List

```
{volume[fe],
  volume[si],
  volume[c],
  volume[al],
  volume[b],
  volume[p],
  volume[ga],
  volume[ge],
  volume[cu],
  volume[ag],
  volume[au],
  volume[zn],
  volume[ti],
  volume[v],
  volume[cr],
  volume[zr],
  volume[nb],
  volume[mo],
  volume[hf],
  volume[ta],
  volume[w],
  volume[ce],
  volume[pr],
  volume[gd],
  volume[u]} = atomicVolumes[[Flatten[Position[atomicVolumes, {#, _}]]][[1, 2]] & /@ {26,
   14, 6, 13, 5, 15, 31, 32, 29, 47, 79, 30, 22, 23, 24, 40, 41, 42, 72, 73, 74, 58, 59, 64, 92}
```

```
{25.5004, 9.18631, 2.02021, 11.0362, 4.42313, 6.32194, 16.8962, 13.1191,
 20.4775, 30.1734, 35.3851, 19.2326, 36.6193, 33.5862, 30.7253, 58.7184,
 52.1396, 46.0716, 60.4453, 53.7356, 48.2886, 102.454, 101.219, 84.965, 81.7252}
```

Cross Section List

```
{xArea[fe],
  xArea[si],
  xArea[c],
  xArea[al],
  xArea[b],
  xArea[p],
  xArea[ga],
  xArea[ge],
  xArea[cu],
  xArea[ag],
  xArea[au],
  xArea[zn],
  xArea[ti],
  xArea[v],
  xArea[cr],
  xArea[zr],
  xArea[nb],
  xArea[mo],
  xArea[hf],
  xArea[ta],
  xArea[w],
  xArea[ce],
  xArea[pr],
  xArea[gd],
  xArea[u]} =
 atomicCrossSection[[Flatten[Position[atomicCrossSection, {#, _}]]][[1, 2]] & /@ {26, 14, 6,
   13, 5, 15, 31, 32, 29, 47, 79, 30, 22, 23, 24, 40, 41, 42, 72, 73, 74, 58, 59, 64, 92}]
{8.66358, 4.38626, 1.59808, 4.95692, 2.69455, 3.41901, 6.58455, 5.56248,
 7.48487, 9.69206, 10.7782, 7.17836, 11.0274, 10.4098, 9.8099, 15.1072, 13.9566,
 12.8515, 15.4019, 14.2399, 13.2606, 21.8953, 21.7191, 19.3268, 18.8323}
```

Mass List

```
{mass[fe],
  mass[si],
  mass[c],
  mass[al],
  mass[b],
  mass[p],
  mass[ga],
  mass[ge],
  mass[cu],
  mass[ag],
  mass[au],
  mass[zn],
  mass[ti],
  mass[v],
  mass[cr],
  mass[zr],
  mass[nb],
  mass[mo],
  mass[hf],
  mass[ta],
  mass[w],
  mass[ce],
  mass[pr],
  mass[gd],
  mass[u]} = atomicMasses[[Flatten[Position[atomicMasses, {#, _}]]][[1, 2]] & /@ {26, 14, 6,
   13, 5, 15, 31, 32, 29, 47, 79, 30, 22, 23, 24, 40, 41, 42, 72, 73, 74, 58, 59, 64, 92}]
```

```
{55.845, 28.085, 12.011, 26.9815385, 10.81, 30.973761998, 69.723, 72.630,
 63.546, 107.8682, 196.966569, 65.38, 47.867, 50.9415, 51.9961, 91.224, 92.90637,
 95.95, 178.49, 180.94788, 183.84, 140.116, 140.90766, 157.25, 238.02891}
```

Valence Electron List

```
{vElectrons[fe],
  vElectrons[si],
  vElectrons[c],
  vElectrons[al],
  vElectrons[b],
  vElectrons[p],
  vElectrons[ga],
  vElectrons[ge],
  vElectrons[cu],
  vElectrons[ag],
  vElectrons[au],
  vElectrons[zn],
  vElectrons[ti],
  vElectrons[v],
  vElectrons[cr],
  vElectrons[zr],
  vElectrons[nb],
  vElectrons[mo],
  vElectrons[hf],
  vElectrons[ta],
  vElectrons[w],
  vElectrons[ce],
  vElectrons[pr],
  vElectrons[gd],
  vElectrons[u]} =
 atomicValenceElectrons[[Flatten[Position[atomicValenceElectrons, {#, _}]]][[1, 2]] & /@ {26,
   14, 6, 13, 5, 15, 31, 32, 29, 47, 79, 30, 22, 23, 24, 40, 41, 42, 72, 73, 74, 58, 59, 64, 92}]
```

```
{8, 4, 4, 3, 3, 5, 3, 4, 11, 11, 11, 12, 4, 5, 6, 4, 5, 6, 4, 5, 6, 3, 8, 3, 3}
```

Late Transition Transforms

```
{vElectrons[cu], vElectrons[ag], vElectrons[au], vElectrons[zn]} = {2, 1, 3, 2}
```

```
{2, 1, 3, 2}
```

```
lateVolumes = {volume[cu], volume[ag], volume[au], volume[zn]};
lateXAreas = {xArea[cu], xArea[ag], xArea[au], xArea[zn]};
lateMasses = {mass[cu], mass[ag], mass[au], mass[zn]};
lateVElectrons = {vElectrons[cu], vElectrons[ag], vElectrons[au], vElectrons[zn]};
```

```
lateTransitionWeightedVolume = Quiet[
    Total[lateVolumes[[#]] * lateFeatures[[#]] & /@ Range[1, Length[lateFeatures]], {1}]
    / lateTransitionTotal] /.
  {Indeterminate → 0};
lateTransitionWeightedArea =
  Quiet[Total[lateXAreas[[#]] * lateFeatures[[#]] & /@ Range[1, Length[lateFeatures]], {1}]
    / lateTransitionTotal] /.
  {Indeterminate → 0};
lateTransitionWeightedMass =
  Quiet[Total[lateMasses[[#]] * lateFeatures[[#]] & /@ Range[1, Length[lateFeatures]], {1}]
    / lateTransitionTotal] /.
  {Indeterminate → 0};
lateTransitionMeanVElectrons = Quiet[
    Total[N@lateVElectrons[[#]] * lateFeatures[[#]] & /@ Range[1, Length[lateFeatures]], {1}]
    / lateTransitionTotal]
  /. {Indeterminate → 0};
```

Early Transition Transforms

```
earlyVolumes = {volume[ti], volume[v], volume[cr], volume[zr], volume[nb], volume[mo],
   volume[hf], volume[ta], volume[w], volume[ce], volume[pr], volume[gd], volume[u]};
earlyXAreas = {xArea[ti], xArea[v], xArea[cr], xArea[zr], xArea[nb], xArea[mo],
   xArea[hf], xArea[ta], xArea[w], xArea[ce], xArea[pr], xArea[gd], xArea[u]};
earlyMasses = {mass[ti], mass[v], mass[cr], mass[zr], mass[nb], mass[mo],
   mass[hf], mass[ta], mass[w], mass[ce], mass[pr], mass[gd], mass[u]};
earlyVElectrons = {vElectrons[ti], vElectrons[v], vElectrons[cr], vElectrons[zr],
   vElectrons[nb], vElectrons[mo], vElectrons[hf], vElectrons[ta], vElectrons[w],
   vElectrons[ce], vElectrons[pr], vElectrons[gd], vElectrons[u]};

earlyTransitionWeightedVolume = Quiet[
    Total[earlyVolumes[[#]] * earlyFeatures[[#]] & /@ Range[1, Length[earlyFeatures]], {1}]
    / earlyTransitionTotal] /.
  {Indeterminate → 0};
earlyTransitionWeightedArea = Quiet[
    Total[earlyXAreas[[#]] * earlyFeatures[[#]] & /@ Range[1, Length[earlyFeatures]], {1}]
    / earlyTransitionTotal] /.
  {Indeterminate → 0};
earlyTransitionWeightedMass = Quiet[
    Total[earlyMasses[[#]] * earlyFeatures[[#]] & /@ Range[1, Length[earlyFeatures]], {1}]
    / earlyTransitionTotal] /.
  {Indeterminate → 0};
earlyTransitionMeanVElectrons =
  Quiet[1 / earlyTransitionTotal Total[N@earlyVElectrons[[#]] * earlyFeatures[[#]] & /@
      Range[1, Length[earlyFeatures]], {1}]] /. {Indeterminate → 0};
```

Temperature Differences

```
deltaT0 = annealingTemp - primaryCrystalOnset /. ___ - _ → "";
deltaT1 = annealingTemp - primaryCrystalPeak /. ___ - _ → "";
deltaT2 = annealingTemp - secondaryCrystalPeak /. ___ - _ → "";
```

Element Identity String

```
elementFeatures = {percentFe, percentSi, percentC, percentAl, percentB,
  percentP, percentGa, percentGe, lateTransitionTotal, earlyTransitionTotal}
```

```
{ ··· 1 ··· }
```

large output | show less | show more | show all | set size limit...

```
compRows = Transpose[elementFeatures]
```

```
{{72.5, 13.5, 0, 0, 9, 0, 0, 1, 1, 3}, {71.5, 9.5, 0, 1, 9, 0, 0, 5, 1, 3},
 {73.5, 13.5, 0, 0, 9, 0, 0, 0, 1, 3}, {73.5, 13.5, 0, 0, 9, 0, 0, 0, 1, 3},
 {73.5, 13.5, 0, 0, 7, 0, 0, 2, 1, 3}, ··· 1284 ···, {81, 4, 0, 0, 13, 0, 0, 0, 2, 0},
 {81.3, 4, 0, 0, 13, 0, 0, 0, 1.7, 0}, {81.3, 4, 0, 0, 13, 0, 0, 0, 1.7, 0},
 {81.3, 4, 0, 0, 13, 0, 0, 0, 1.7, 0}, {81, 4, 0, 0, 13, 0, 0, 0, 2, 0}}
```

large output | show less | show more | show all | set size limit...

```
isPresent[amount_] := Piecewise[{{"0", amount == 0}, {"1", amount ≠ 0}}]

compID[elements_] := Module[
  {compstring = ""},
  For[
   i = 1, i ≤ Length[elements], i++,
   compstring = compstring <> isPresent[elements[[i]]]
  ];
  compstring
 ]

compIDColumn = compID[#] & /@ compRows;
```

New Data Set

```
newLabels = {"Total SiCAl", "Total BP", "Total GaGe",
   "Total Late Transition", "Total Early Transition", "Relative to Fe SiCAl",
   "Relative to Fe BP", "Relative to Fe GaGe", "Relative to Fe Early",
   "Relative to Fe Late", "Relative to Late Early", "Relative to Early SiCAl",
   "Relative to Late SiCAl", "Relative to Early BP", "Relative to Late BP",
   "Relative to Early GaGe", "Relative to Late GaGe", "Late Weighted Volume",
   "Late Weighted Area", "Late Weighted Mass", "Late Mean Electrons",
   "Early Weighted Volume", "Early Weighted Area", "Early Weighted Mass",
   "Early Mean Electrons", "Delta T0", "Delta T1", "Delta T2"};

allLabels = Join[newLabels, rawLabels];

newFeatures = {percentSiCAl, percentBP, percentGaGe, lateTransitionTotal,
   earlyTransitionTotal, relativeToFeSiCAl, relativeToFeBP, relativeToFeGaGe,
   relativeToFeEarlyTransition, relativeToFeLateTransition, relativeToLateEarly,
   relativeToEarlySiCAl, relativeToLateSiCAl, relativeToEarlyBP, relativeToLateBP,
   relativeToEarlyGaGe, relativeToLateGaGe, lateTransitionWeightedVolume,
   lateTransitionWeightedArea, lateTransitionWeightedMass, lateTransitionMeanVElectrons,
   earlyTransitionWeightedVolume, earlyTransitionWeightedArea,
   earlyTransitionWeightedMass, earlyTransitionMeanVElectrons, deltaT0, deltaT1, deltaT2};

allFeatures = Join[newFeatures, rawFeatures];

targets = {{coercivity, "Coercivity"}, {curieTemp, "Curie Temp"},
   {coreLoss, "Core Loss"}, {electricalResistivity, "Electrical Resistivity"},
   {permeability, "Permeability"}, {magnetostriction, "Magnetostriction"},
   {magneticSaturation, "Magnetic Saturation"}, {grainDiameter, "Grain Diameter"},
   {compIDColumn, "Composition ID"}, {doi, "Reference DOI"}};

masterDataset =
 Prepend[Transpose[Join[allFeatures, targets[[All, 1]]]], Join[allLabels, targets[[All, 2]]]]
Export["MasterDataset7-26.csv", masterDataset]
```

```
{{Total SiCAl, Total BP, Total GaGe, Total Late Transition, Total Early Transition,
  Relative to Fe SiCAl, Relative to Fe BP, Relative to Fe GaGe, ··· 55 ···, Core Loss,
  Electrical Resistivity, Permeability, Magnetostriction, Magnetic Saturation,
  Grain Diameter, Composition ID, Reference DOI}, ··· 1293 ···, {··· 1 ···}}
```

large output | show less | show more | show all | set size limit...

MasterDataset7-26.csv

```
(*fullFeatureDataSet[{target_,label_}]:=
 Prepend[Transpose[Join[allFeatures,{target}]],Join[allLabels,{label}]]
   newFeatureDataSet[{target_,label_}]:=
  Prepend[Transpose[Join[newFeatures,{target}]],Join[newLabels,{label}]]
    rawFeatureDataSet[{target_,label_}]:=
   Prepend[Transpose[Join[rawFeatures,{target}]],Join[rawLabels,{label}]]*)
```

```
(*fullFeatureDataSets=fullFeatureDataSet[#]&/@targets;
newFeatureDataSets=newFeatureDataSet[#]&/@targets;
rawFeatureDataSets=rawFeatureDataSet[#]&/@targets;*)

(*Export["FullFeatureCoercivity.csv",fullFeatureDataSets[[1]]]
 Export["FullFeatureCurieTemp.csv",fullFeatureDataSets[[2]]]
 Export["FullFeatureCoreLoss.csv",fullFeatureDataSets[[3]]]
 Export["FullFeatureElectricalResistivity.csv",fullFeatureDataSets[[4]]]
 Export["FullFeaturePermeability.csv",fullFeatureDataSets[[5]]]
 Export["FullFeatureMagnetostriction.csv",fullFeatureDataSets[[6]]]
 Export["FullFeatureMagneticSaturation.csv",fullFeatureDataSets[[7]]]
 Export["FullFeatureGrainDiameter.csv",fullFeatureDataSets[[8]]]
 Export["FullFeatureLatticeParameter.csv",fullFeatureDataSets[[9]]]*)

(*Export["NewFeatureCoercivity.csv",newFeatureDataSets[[1]]]
 Export["NewFeatureCurieTemp.csv",newFeatureDataSets[[2]]]
 Export["NewFeatureCoreLoss.csv",newFeatureDataSets[[3]]]
 Export["NewFeatureElectricalResistivity.csv",newFeatureDataSets[[4]]]
 Export["NewFeaturePermeability.csv",newFeatureDataSets[[5]]]
 Export["NewFeatureMagnetostriction.csv",newFeatureDataSets[[6]]]
 Export["NewFeatureMagneticSaturation.csv",newFeatureDataSets[[7]]]
 Export["NewFeatureGrainDiameter.csv",newFeatureDataSets[[8]]]
 Export["NewFeatureLatticeParameter.csv",newFeatureDataSets[[9]]]*)

(*Export["RawFeatureCoercivity.csv",rawFeatureDataSets[[1]]]
 Export["RawFeatureCurieTemp.csv",rawFeatureDataSets[[2]]]
 Export["RawFeatureCoreLoss.csv",rawFeatureDataSets[[3]]]
 Export["RawFeatureElectricalResistivity.csv",rawFeatureDataSets[[4]]]
 Export["RawFeaturePermeability.csv",rawFeatureDataSets[[5]]]
 Export["RawFeatureMagnetostriction.csv",rawFeatureDataSets[[6]]]
 Export["RawFeatureMagneticSaturation.csv",rawFeatureDataSets[[7]]]
 Export["RawFeatureGrainDiameter.csv",rawFeatureDataSets[[8]]]
 Export["RawFeatureLatticeParameter.csv",rawFeatureDataSets[[9]]]*)
```