



Institute of Refractories Engineers

Product Assessment

IRE Training Day
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Sheffield

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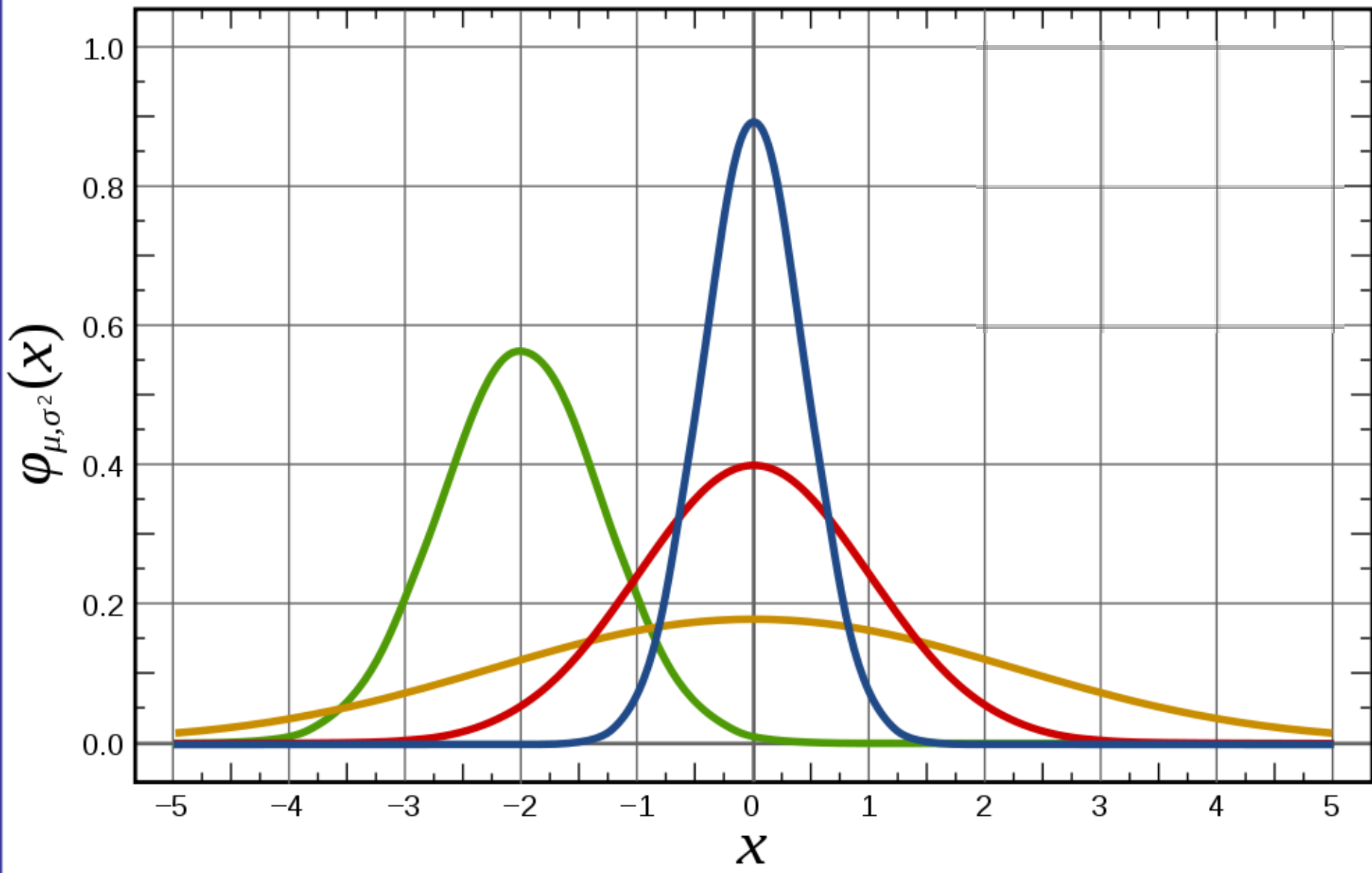


Reliability

- How many tests should we do?
- What is 'normal variation'?
- Is a particular batch within normal variation?
- How do we take opinion out of the decision?



Variability





ISO 5022 Standard

BRITISH STANDARD

BS 6065:1981
ISO 5022:1979

Methods for

Sampling and acceptance testing of shaped refractory products

[ISO title: Shaped refractory products — Sampling and acceptance testing]



What is does

- Gives test levels
- Gives a method to give a clear yes/no decision after allowing for normal variation
- Different methods depending if a fixed limit or guaranteed mean is used, but give same result overall

K_{PRE} for $\alpha = 5 \%$	$\left(\frac{\Delta\mu}{\sigma}\right)_{\beta = 10 \%$	Standard deviation σ unknown	Total mass of batch ^b t
		Sample size, n	
2	3	4	5
0,82	1,46	6	1
0,67	1,20	8	10
0,52	0,93	12	100
0,44	0,78	16	200
0,39	0,69	20	300
0,35	0,62	24	400
0,32	0,58	28	500



Data from Exercise

Assume lot size is 10tonne

K_{PRE} for $\alpha = 5 \%$	$\left(\frac{\Delta\mu}{\sigma}\right)_{\beta = 10 \%$	Standard deviation σ unknown	Total mass of batch ^b t
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This case requires 8 samples

Calculate mean and Standard Deviation for each property from first 8 readings

Note – $K_{PRE} = 0.67$



Data from Exercise

LOT	CCS		BD		AP	
	Mean	SD	Mean	SD	Mean	SD
A	51.5	8.4	2.23	0.04	20.0	1.3
B	58.3	11.8	2.28	0.01	18.5	0.5

Calculate factor from data (ISO 5022 has formula)

Rule governing decision if the high values are unfavourable:

- calculate $\mu_G + K_{PRE} s$;
- if $\bar{x} \leq \mu_G + K_{PRE} s$, the batch is in conformity;
- if $\bar{x} > \mu_G + K_{PRE} s$, the batch is not in conformity.

Rule governing decision if the low values are unfavourable:

- calculate $\mu_G - K_{PRE} s$;
- if $\bar{x} \geq \mu_G - K_{PRE} s$, the batch is in conformity;
- if $\bar{x} < \mu_G - K_{PRE} s$, the batch is not in conformity.

where μ_G is guaranteed mean, s is standard deviation and \bar{x} is the mean, $K_{PRE} = 0.67$ from the table



Decision

LOT	CCS		BD		AP	
	Mean	Factor	Mean	Factor	Mean	Factor
A	51.5	44.4	2.2	2.2	20.0	19.8
B	58.3	42.1	2.3	2.2	18.5	19.3

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Rule governing decision if the low values are unfavourable:

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LOT	CCS		BD		AP	
	Mean	Factor	Mean	Factor	Mean	Factor
A	51.5	44.4	2.2	2.2	20.0	19.8
B	58.3	42.1	2.3	2.2	18.5	19.3



What it does NOT do

- Say what property value should be
 - What is the limit for porosity? 17%, 18%, 19%....
- Say if a product is fit for purpose if it meets the specification
- Remove all risk and doubt



CONCLUSIONS

- Correct Property measurement is important for product assessment by users and for control of the manufacturing process
- Different property measurements have different uses
- Standardisation of methods is important to enable results to be compared
- This leads to meaningful data sheets and specifications
- A data sheet and a specification are for different purposes and must not be confused



Thank You For Your Attention