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a Spirit of Partnership

Wall Thickness Distribution

Nordic ARM Academy
Stockholm 6th of February 2019

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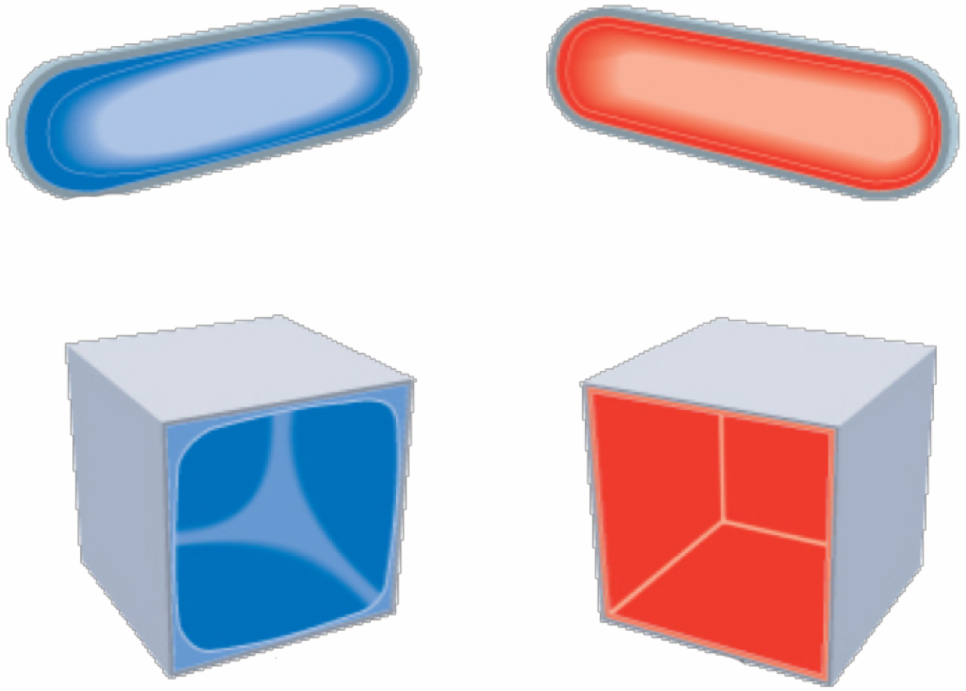
Wall thickness distribution
Industry average

Industry average: 20% *

Good moulders: >10%

As a result of this wide tolerance, in rotational molding, it is common to specify minimum wall thickness rather than nominal wall thickness.



*(Crawford, Thorne, Nugent and more)

Wall Thickness Distribution
Why is it important to control?

1: Lower cost
2: Improved mechanical properties
3: Easier processing
4: Improved aesthetics

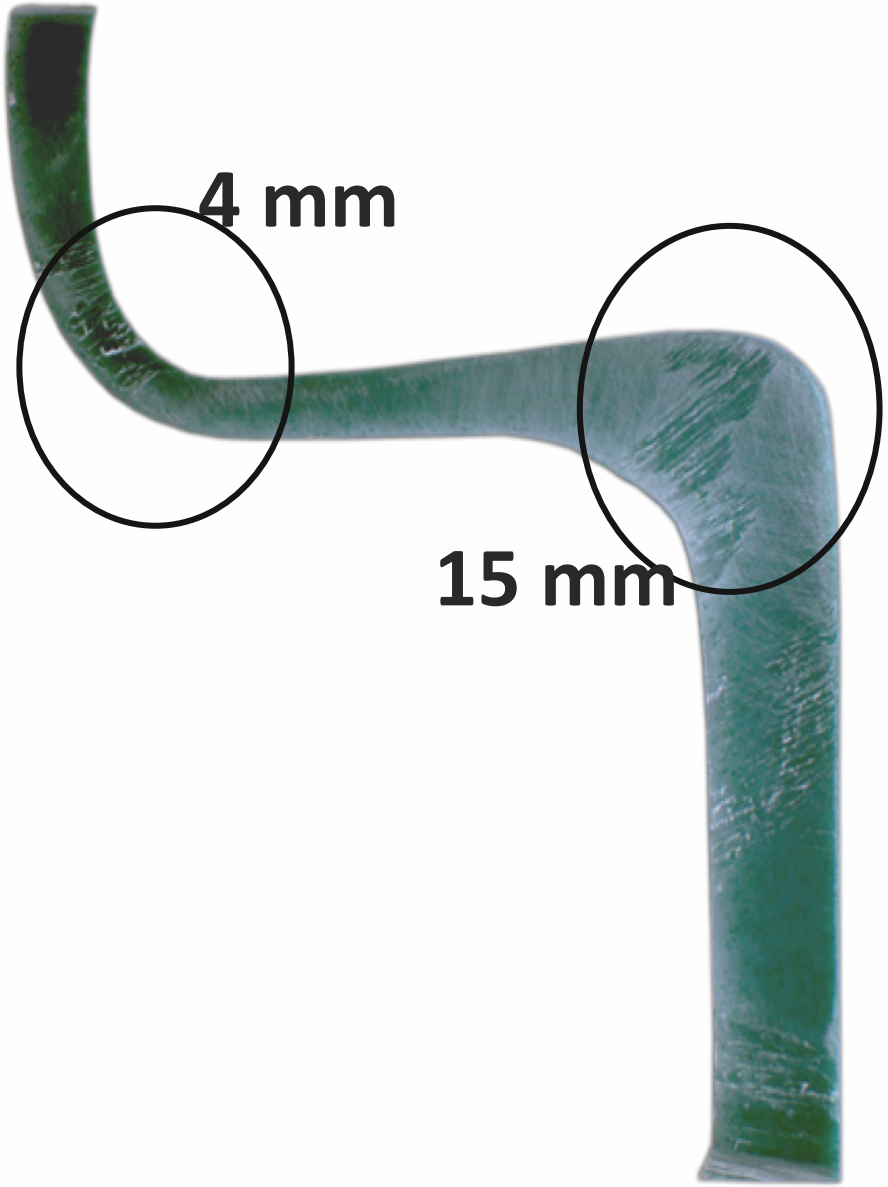
Cost

Even wall thickness distribution equals:

-less material usage

-shorter cycle time

If foaming: double up



Cost example

Pontoon - material

400 litre ≅ 340 dm^2 = 3,4m^2

Minimum wall thickness = 4 mm

3,4 * 0,004 * 935 + 20% = 15,5 kg

Moulder use 18,5 kg.
3 kg or €6 more pr product.

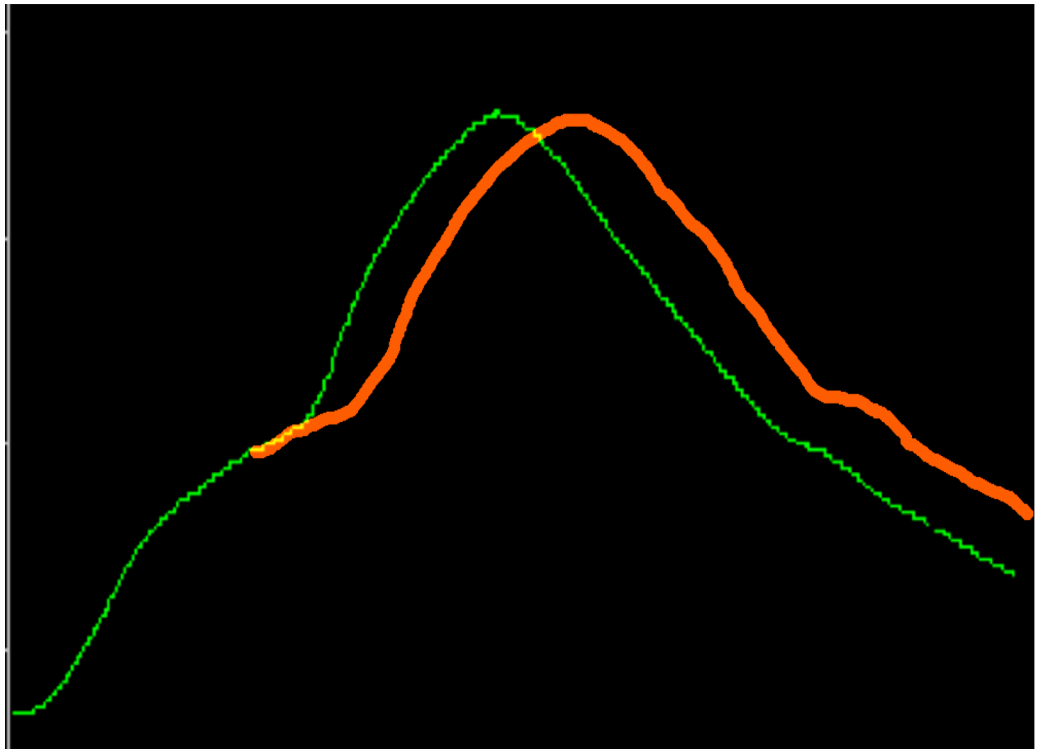
Cost example

Pontoon – cycle time

Assume following cost pr hour:

Machine depreciation	:	€25
Energy	:	€10
Labour, 1 pers	:	€30
(Mould depreciation	:	€5)
Total		€65/h
		€1/min

2 minutes extra cycle time = €2/pr poduct*



*if only one mould on the arm

Cost example
Pontoon

Material	+€6
Cycle time	+€2
Total	+€8/product

Assume 500 products pr year.
€4000 is lost pr product/year

Mechanical properties

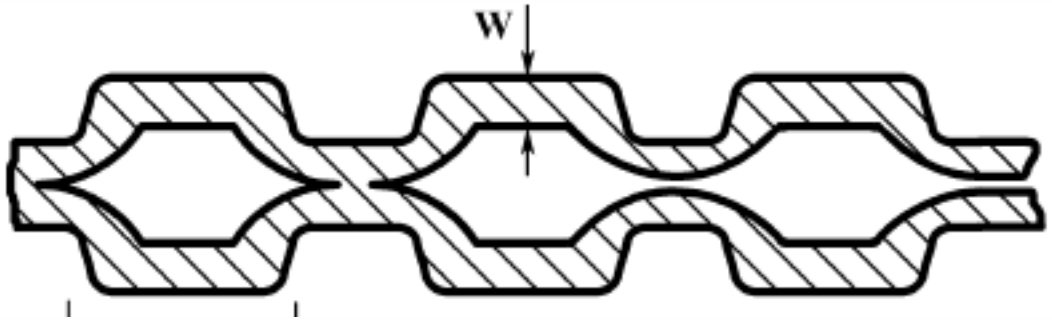
Differ with wall thickness

-Stiffness

-Impact strength

-Kiss offs

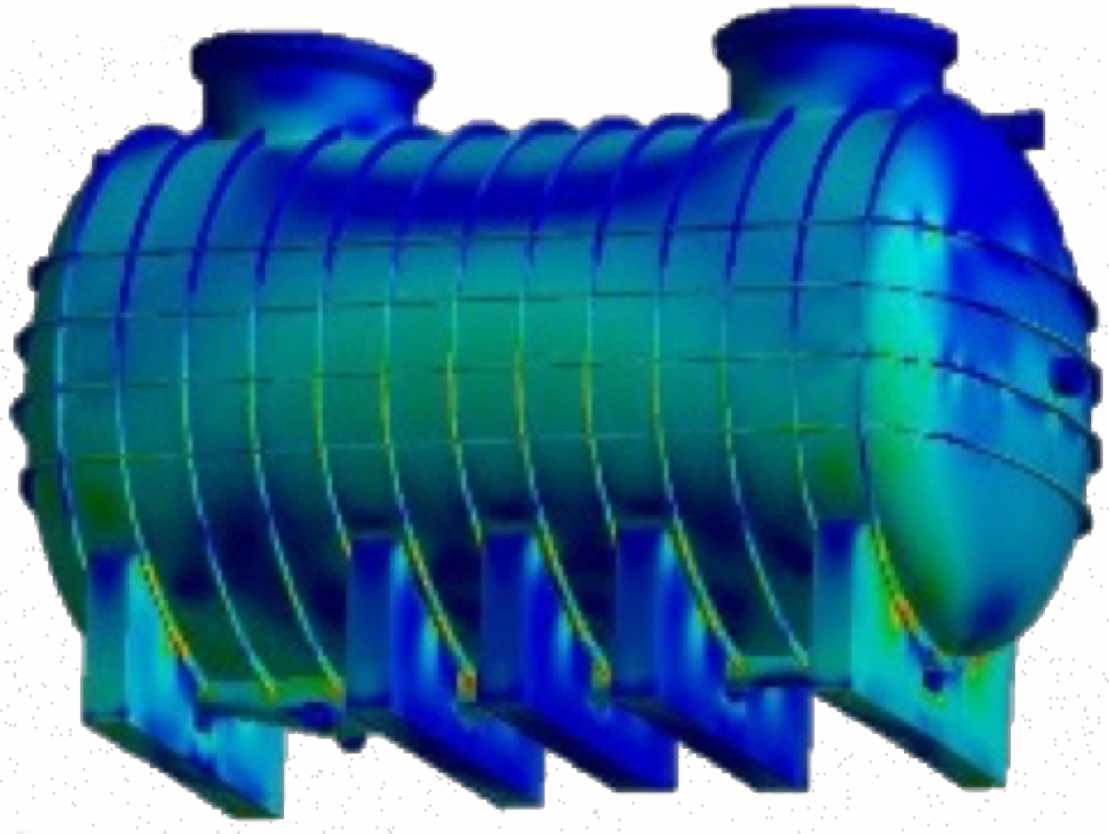
-Fatigue



Mechanical properties
Fatigue

Fatigue is the weakening of a material caused by repeatedly applied loads.

Finite element analysis is often used to characterise the strength of a product



Mechanical properties
Fatigue

-Tank mould made in cooperation with toolmaker

-1/8 of a normal tank

-Radii as described in literature

-Vertical and horizontal ribs

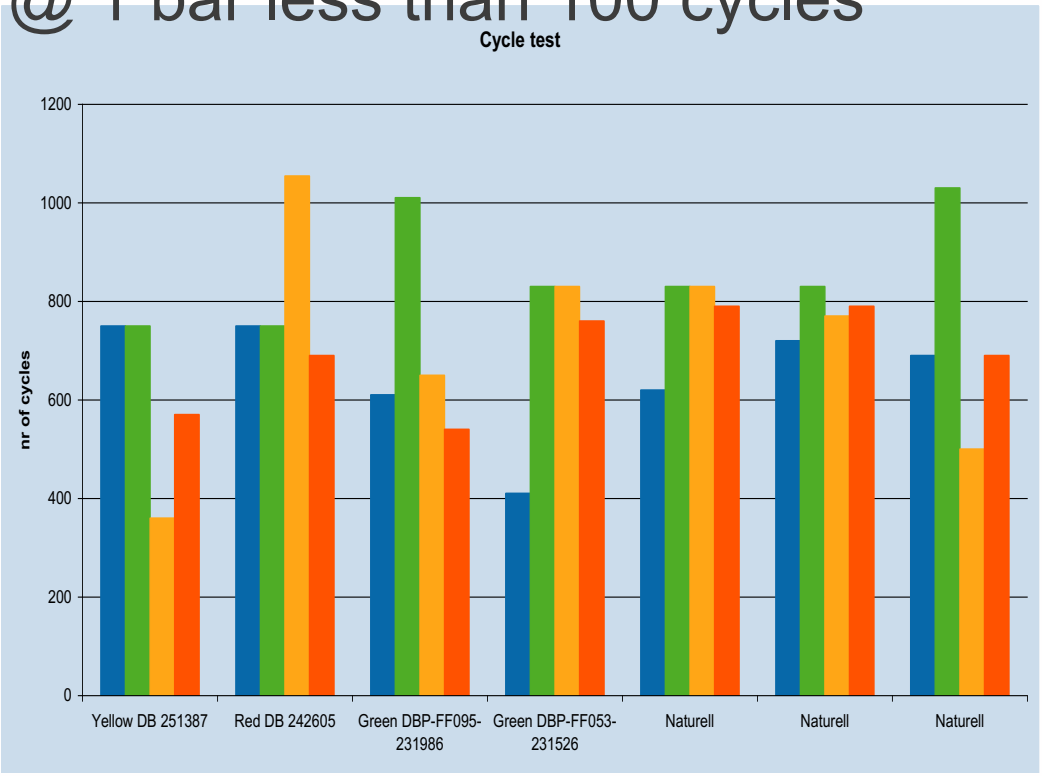
-Narrow sections

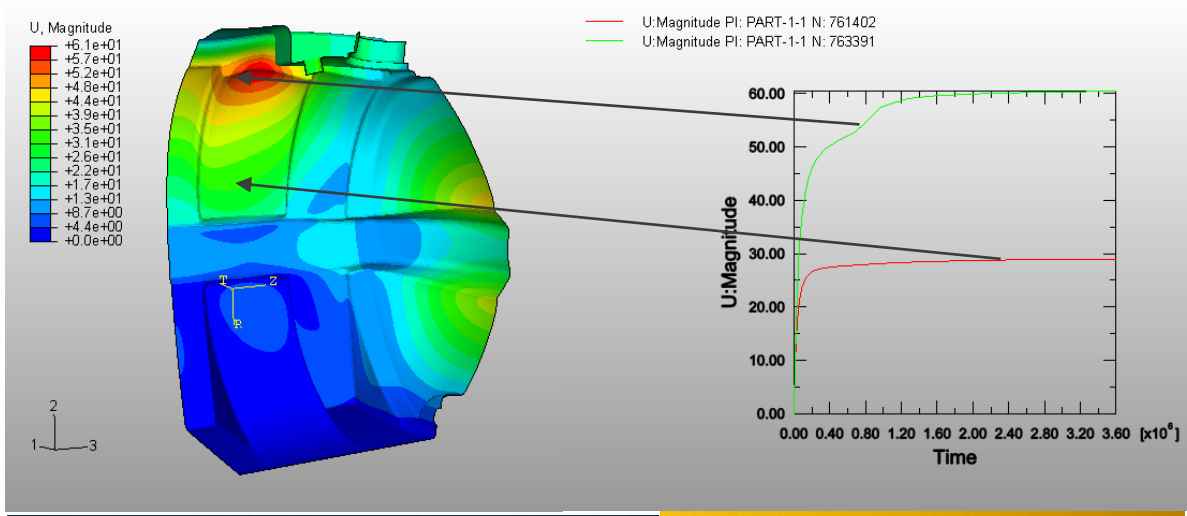
-Threads

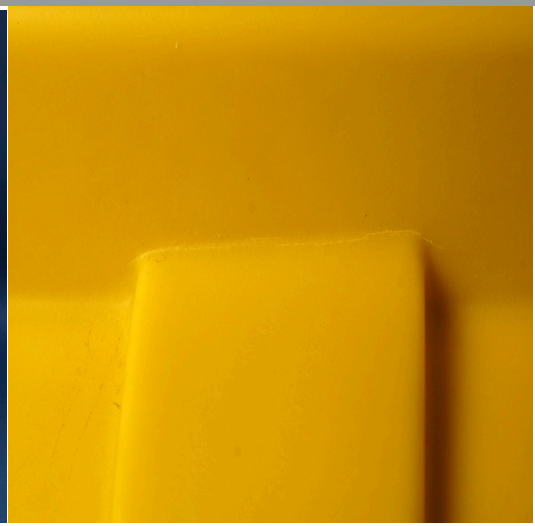
Mechanical properties
Fatigue

Cycling with a pressure of 0,1 bar

@ 1 bar less than 100 cycles







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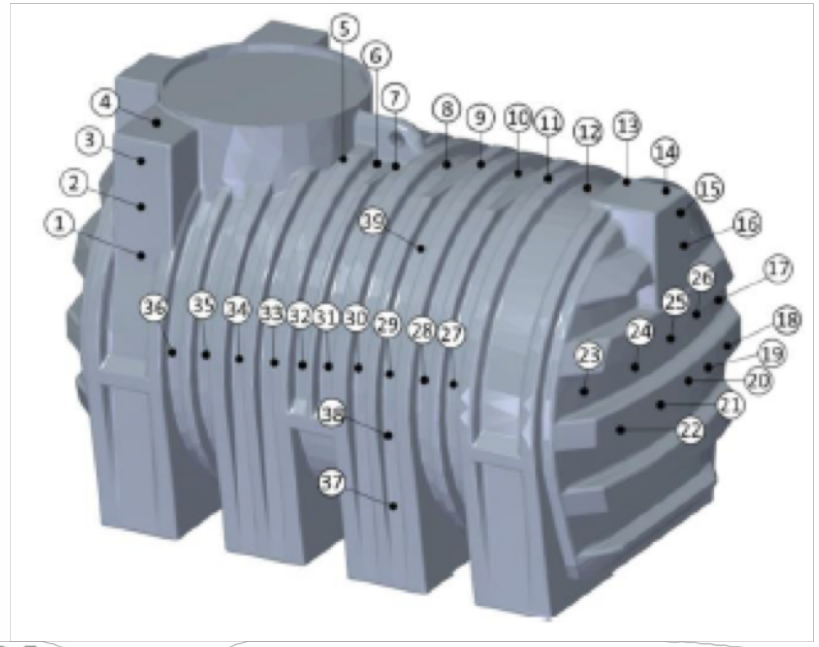
Easier processing

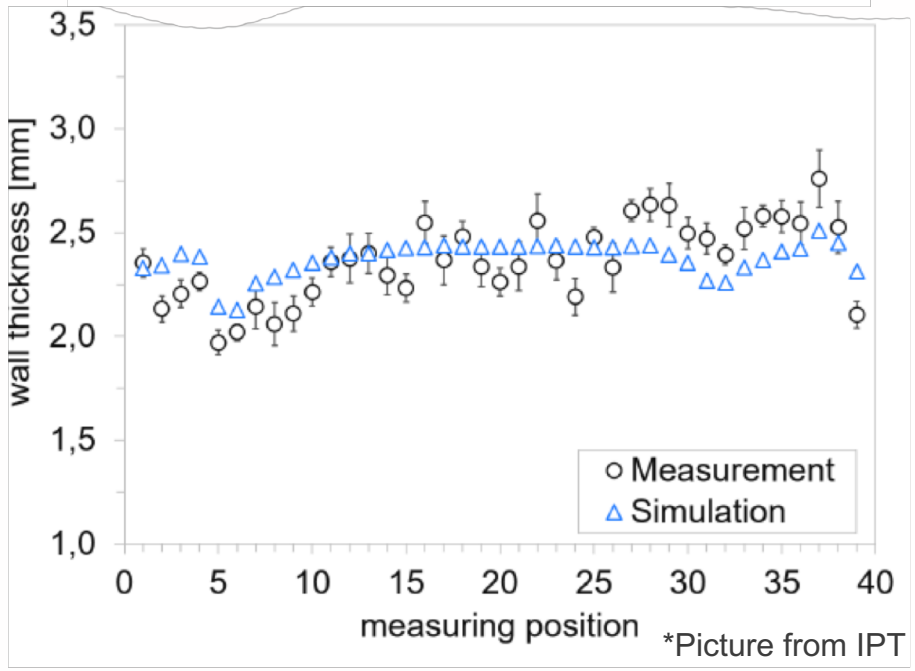
With good control over the wall thickness distribution it is easier to make good products and faster to get first series approved.

-Software

-Weight calculation

-Shrinkage calculation





*Picture from IPT

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Improved aesthetics

-Less warpage
-Easier demoulding
-Less jigging and pressurisation

-Especially if foaming

Warpage

Warpage is just uneven shrinkage

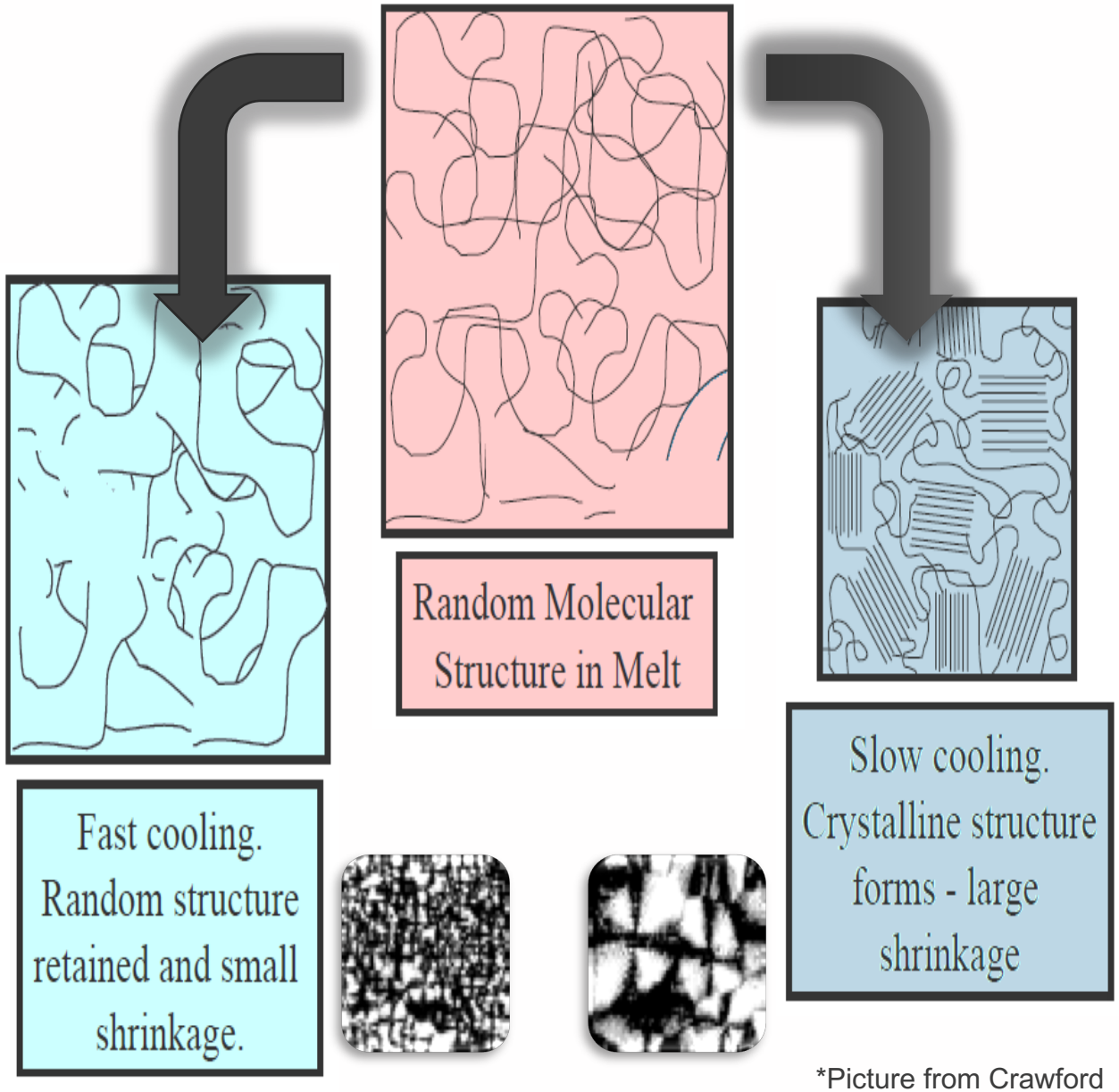
Temperature gradient = cooling gradient

Cooling gradient = crystallinity gradient

Crystallinity gradient = shrinkage gradient

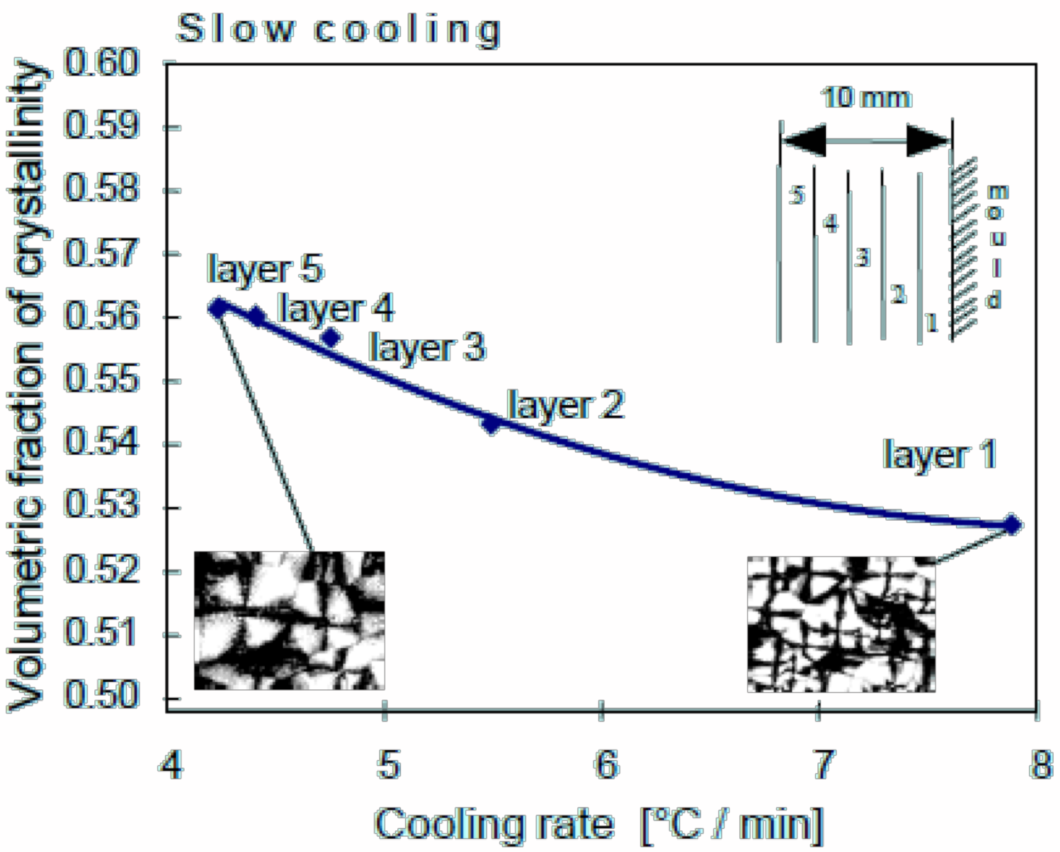
Shrinkage gradient = warpage

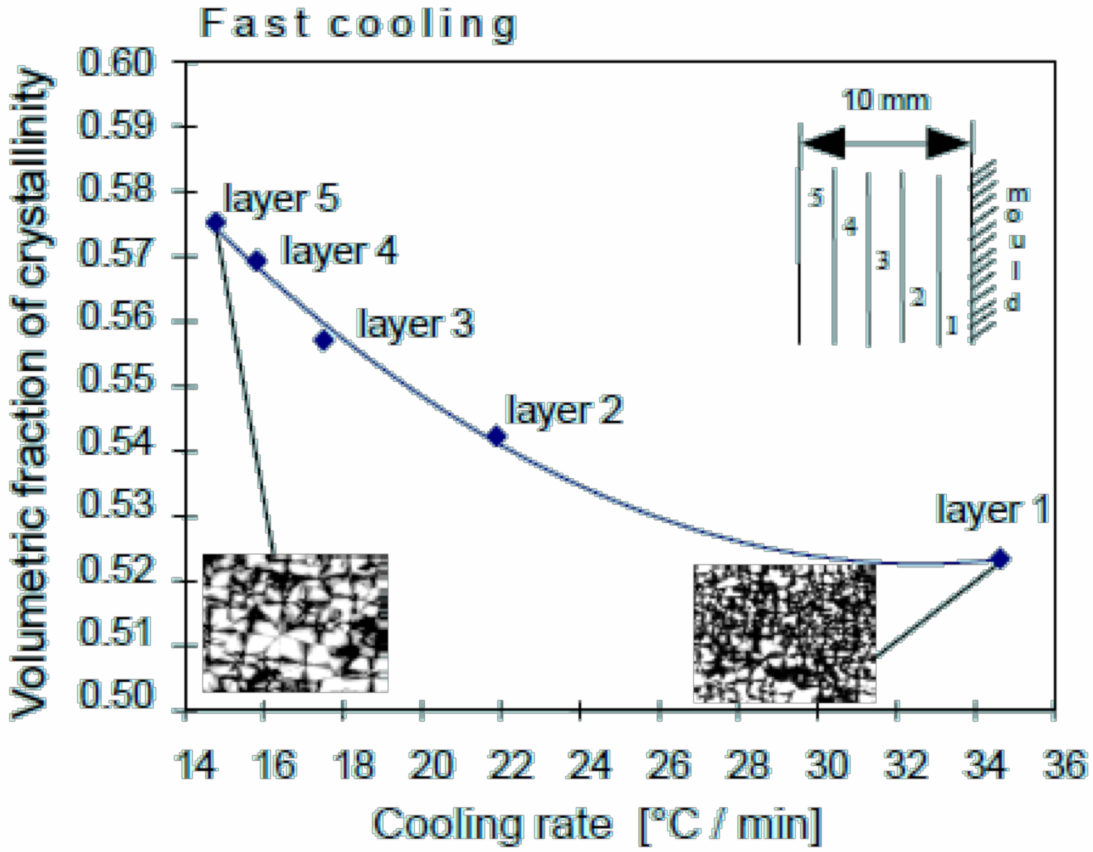
*Quote from Laws



*Picture from Crawford

Warpage





*Picture from Crawford

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So what next?

Get an ultrasonic measuing device and start measuring.