KEIRYO PACKAGING SA

Maximizing materials efficiency for a better environment

The KP Technology Platform
Injection Stretch Blow Molding
Direct Injection

February 2019

About this document

This document has been created by Keiryo Packaging SA for the purpose of providing the reader with further detailed perspectives on the selected topic.

Although carefully established, the document does not seek to be complete or exhaustive on the selected topic.

The representatives of Keiryo Packaging are always available to provide further context and to enter into continued dialogue should this be desired. Please refer to the ‘About Us’ page on the website to find the appropriate contact details.

Meanwhile, enjoy the read and we are looking forward to be hearing from you.

The KP Technology leverages the macromolecular dynamics of the semi-crystalline polymer material

CONVENTIONAL PARADIGM

Considering the material bulk dynamics only :
accepting associated limitations

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Belief :
Exposure to deformational flow is inherently bad for the material

Molecular dynamics are not leveraged beyond the limitations imposed by the bulk polymer material

Conventional processing technologies have fully exploited material capabilities

KEIRYO PACKAGING PARADIGM

Leveraging the material macromolecular dynamics :
creating opportunities

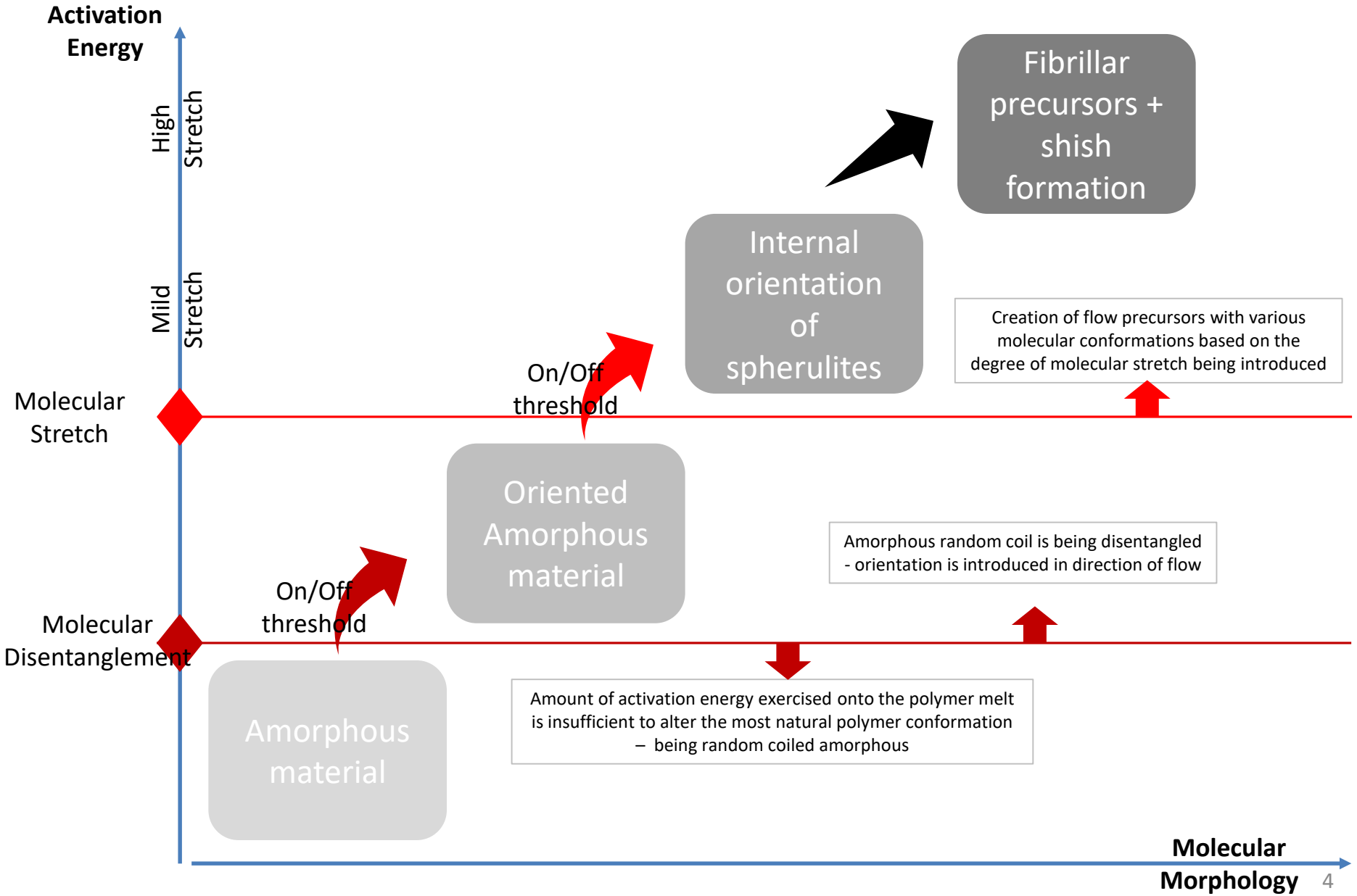
+

Fact :
Controlled deformational flow does not harm the material

Activate flow enhanced nucleation & induced crystallization to leverage the molecular dynamics

KP Technology can further exploit material capabilities

The deformational flows provide the activation energy required to introduce changes to the molecular morphology of the polymer melt



KP Technology is introduced through 3D metal printed KP Products inserted into the hot runner nozzle housing of a conventional injection set-up

Conventional plastic polymer

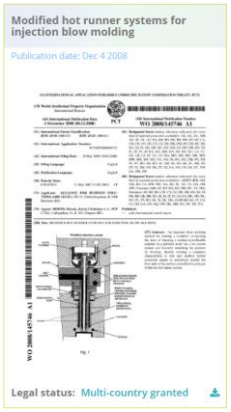
Conventional Hot runner nozzle cavity

Additional KP Product

Conventional Injection cavity (ex. Preform)

Conventional industrial production assets

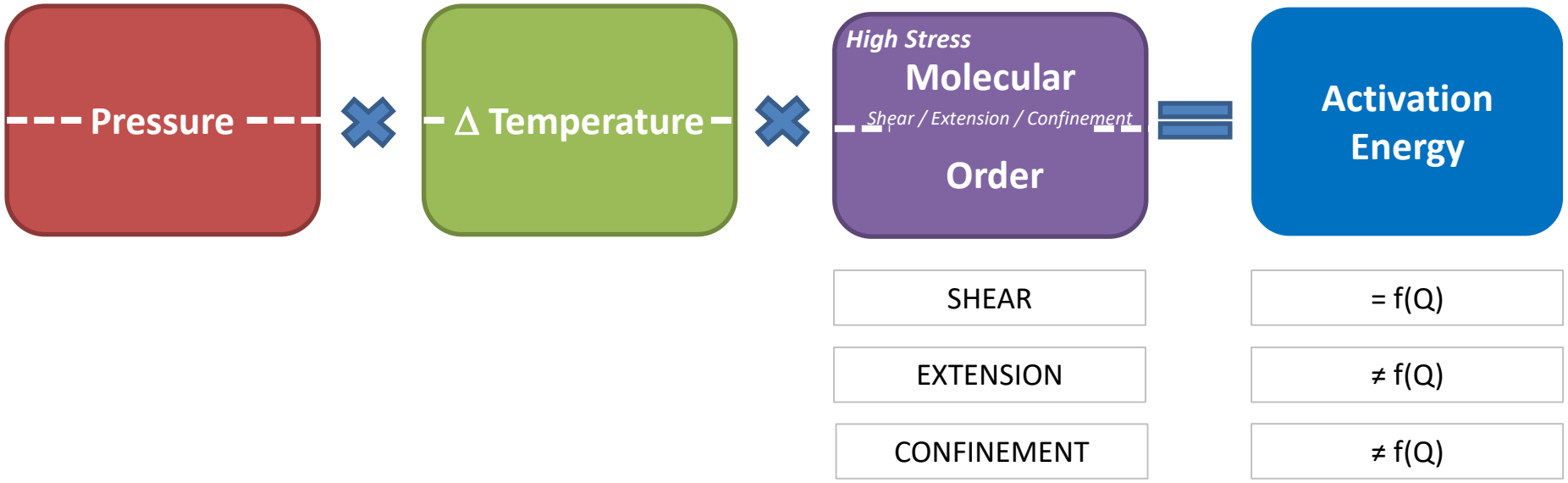
KP PRODUCTS DELIVER THE REQUIRED ACTIVATION ENERGY ONTO THE POLYMER MELT WHEN PASSING THROUGH THE ENGINEERED FLOW CHANNELS


Modified hot runner systems for injection blow molding

Publication date: Dec 4 2008

Legal status: Multi-country granted

The KP Products introduce the required activation energy into the polymer melt

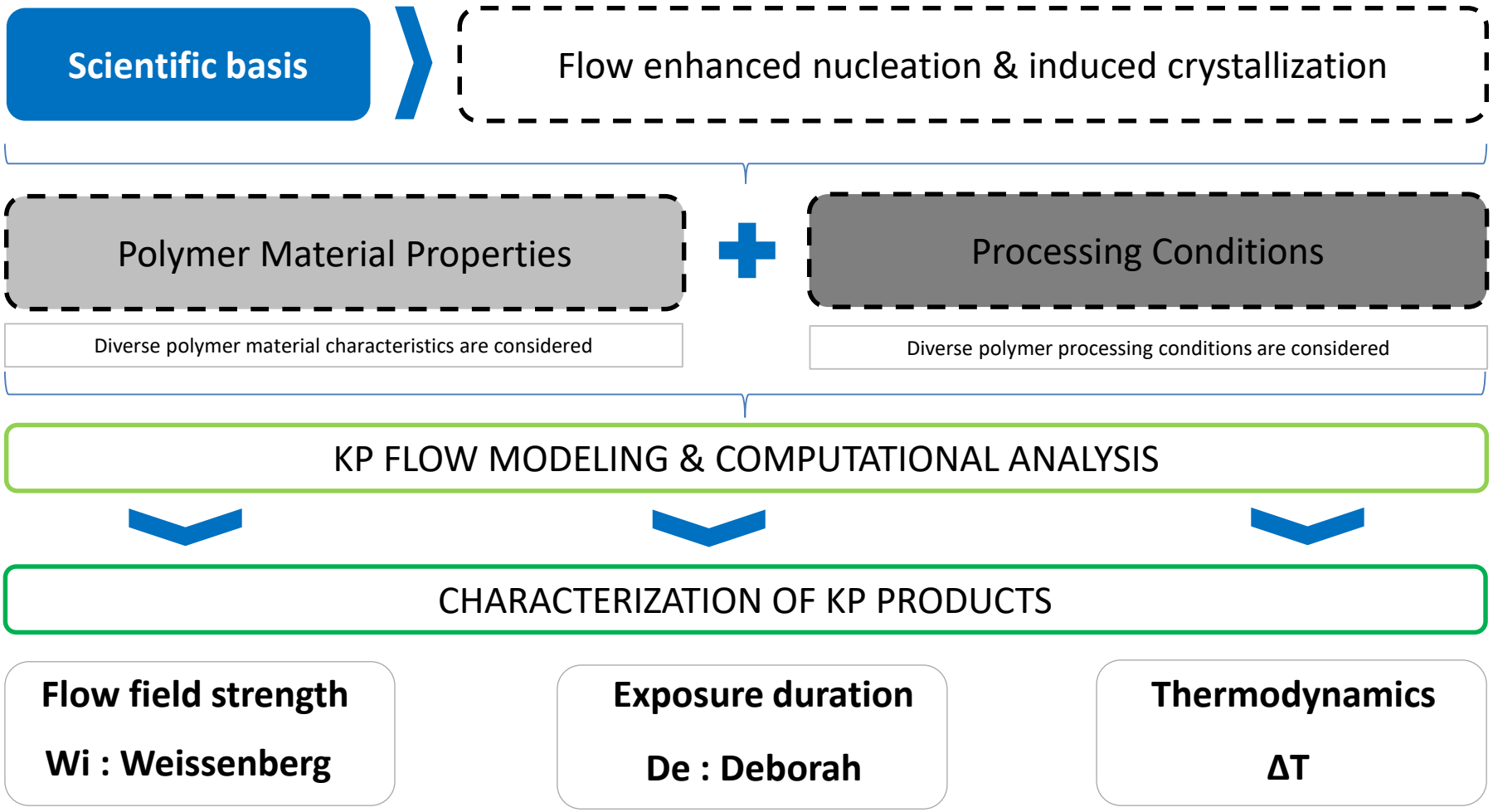


- The **activation energy** results from the degree of **molecular ordering** which is being introduced into the polymer melt under an increased **local pressure** and pressure-corrected local polymer **melt temperature**

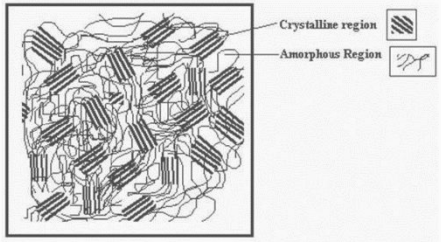
- **Molecular Ordering** is realized through a **designed** combination of **shear**-based, **extensional**-based and **confinement**-based molecular deformation

- Only the shear-based deformation is scaling with the injection volume rate Q

The KP Products deliver an engineered activation energy which is calculated based on internally developed flow modeling & computational analysis



PET ISBM : changing preform molecular morphology prior to stretch blow molding



Polymer crystallization level governs material properties

PET has both amorphous and crystallize regions

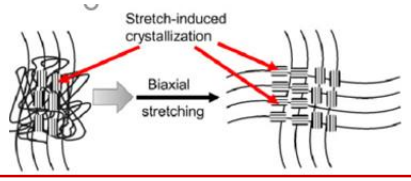
Balance amorphous / crystalline regions determines performances

CONVENTIONAL TECHNOLOGY

1 PET material remains essentially amorphous after preform injection

Conventional technology avoids any thermally induced crystallization in the preform

2 Bottle functionality obtained through stretch blowing

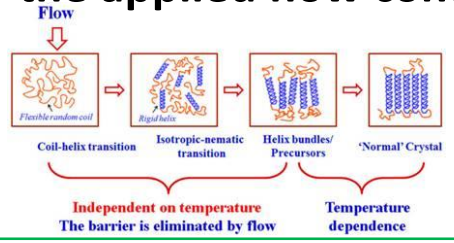


Crystal formation through material bi-axial stretching

UNDERUTILIZES MATERIAL PERFORMANCES

KP TECHNOLOGY

1 PET material is self re-enforcing under the applied flow conditions



2 Bottle functionality obtained through injection & stretch blowing

INCREASED **ORIENTATION**

POLYMER **REINFORCEMENT**

OPTIMIZES MATERIAL PERFORMANCES

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