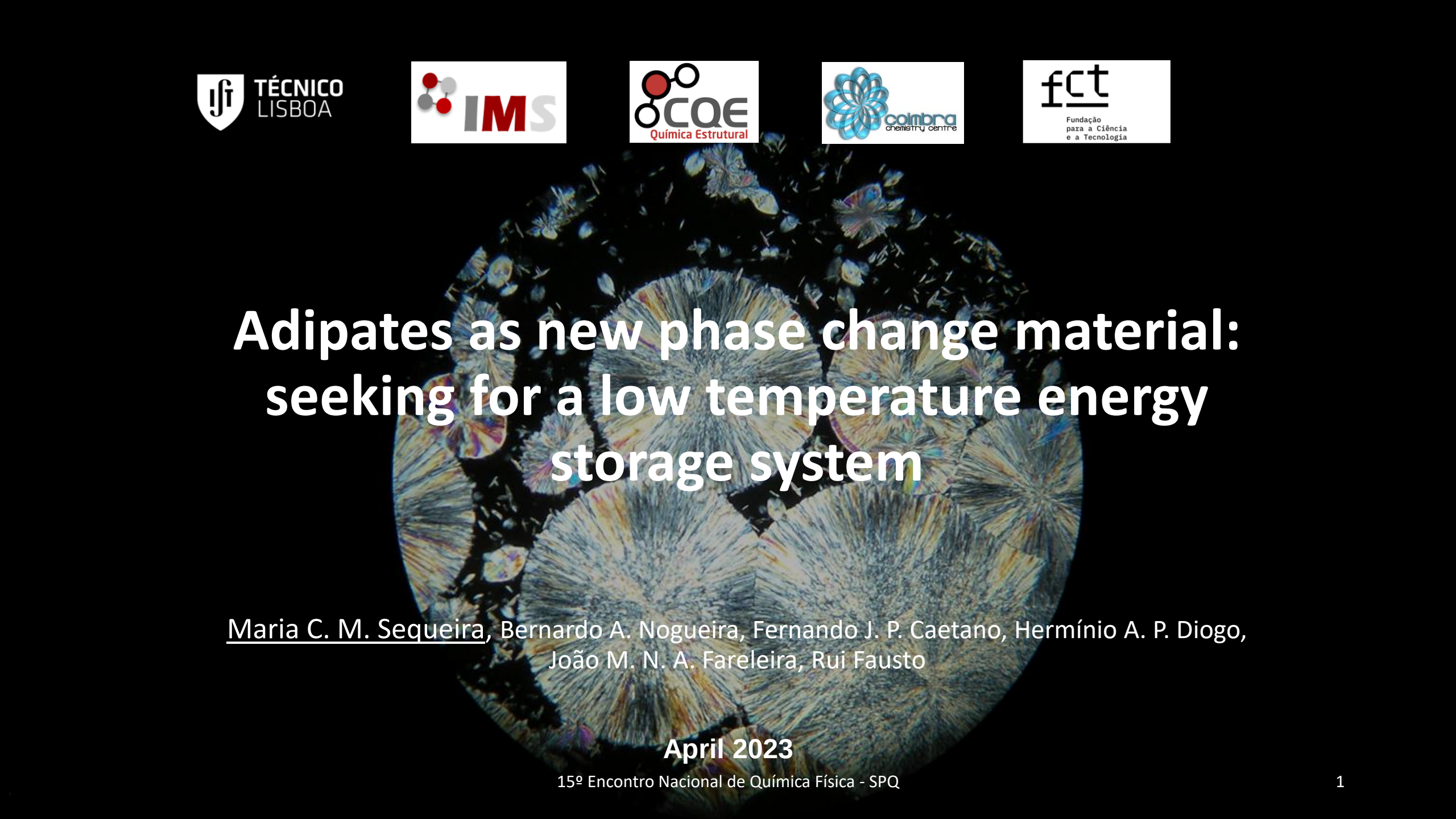


Adipates as new phase change material: seeking for a low temperature energy storage system

Maria C. M. Sequeira, Bernardo A. Nogueira, Fernando J. P. Caetano, Hermínio A. P. Diogo, João M. N. A. Fareleira, Rui Fausto

April 2023

Index

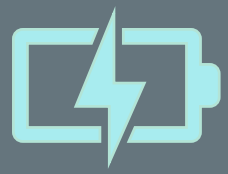
1. Background and Purpose

Background

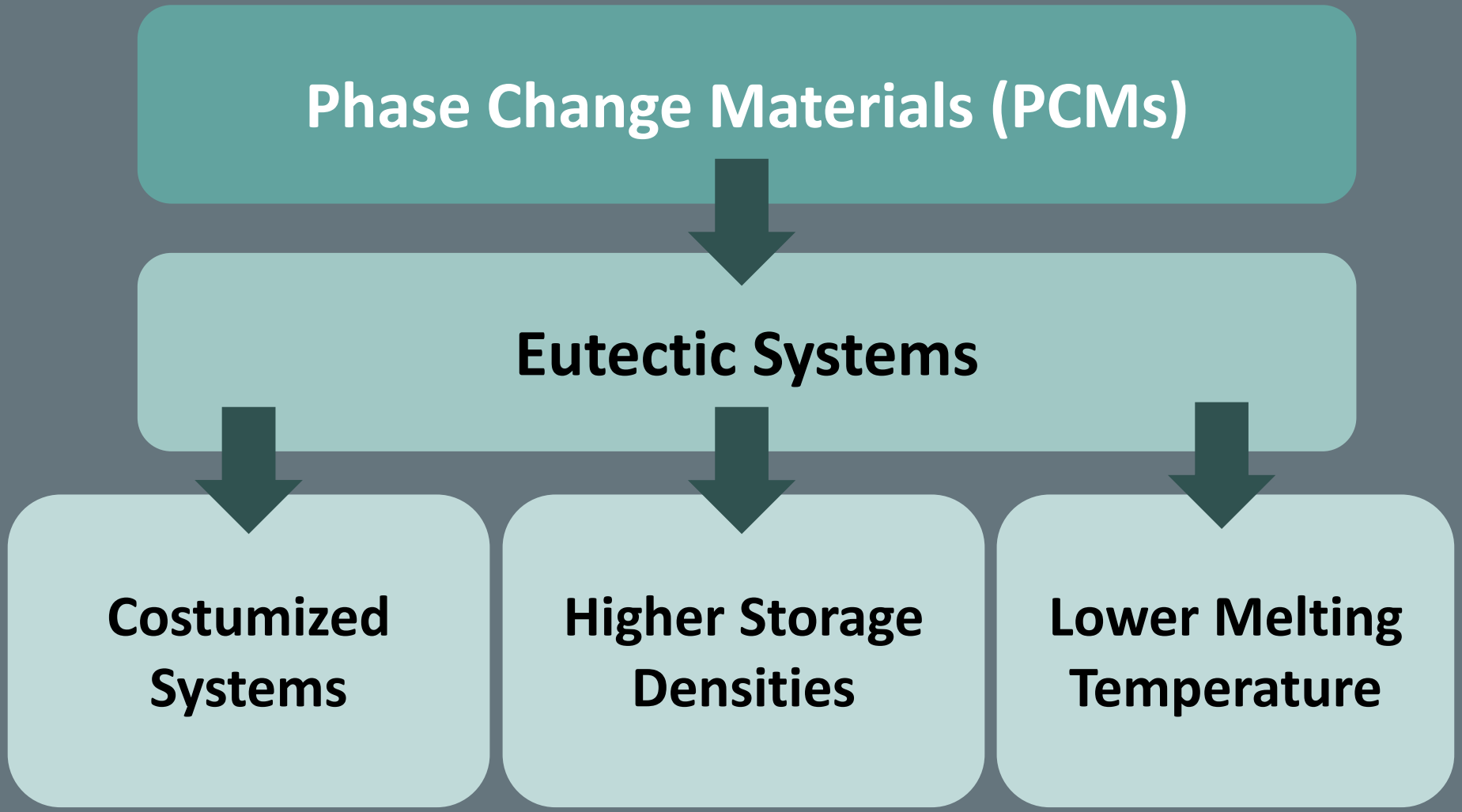
Increasing Energy Needs

Limited Energy Resources

Renewable Energy



Thermal Energy Storage at low T


Phase Change Materials (PCMs)
Eutectic Systems
Costumized Systems
Higher Storage Densities
Lower Melting Temperature

Purpose

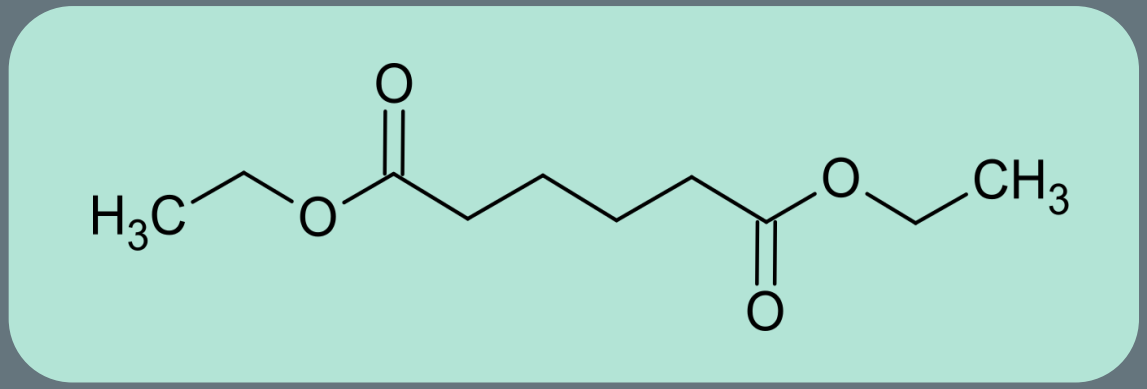
Investigate new PCMs

New Experimental Data

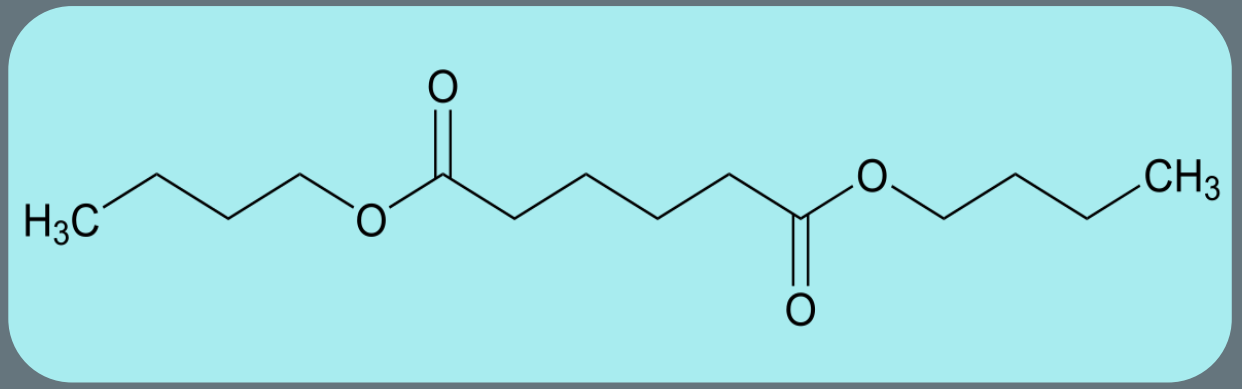
Large Scale Application

2. Experimental Work

Materials



Diethyl Adipate



Dibutyl Adipate

Methods

Hot Stage Microscopy (HSM)

Differential Scanning Calorimetry (DSC)

Raman Spectroscopy

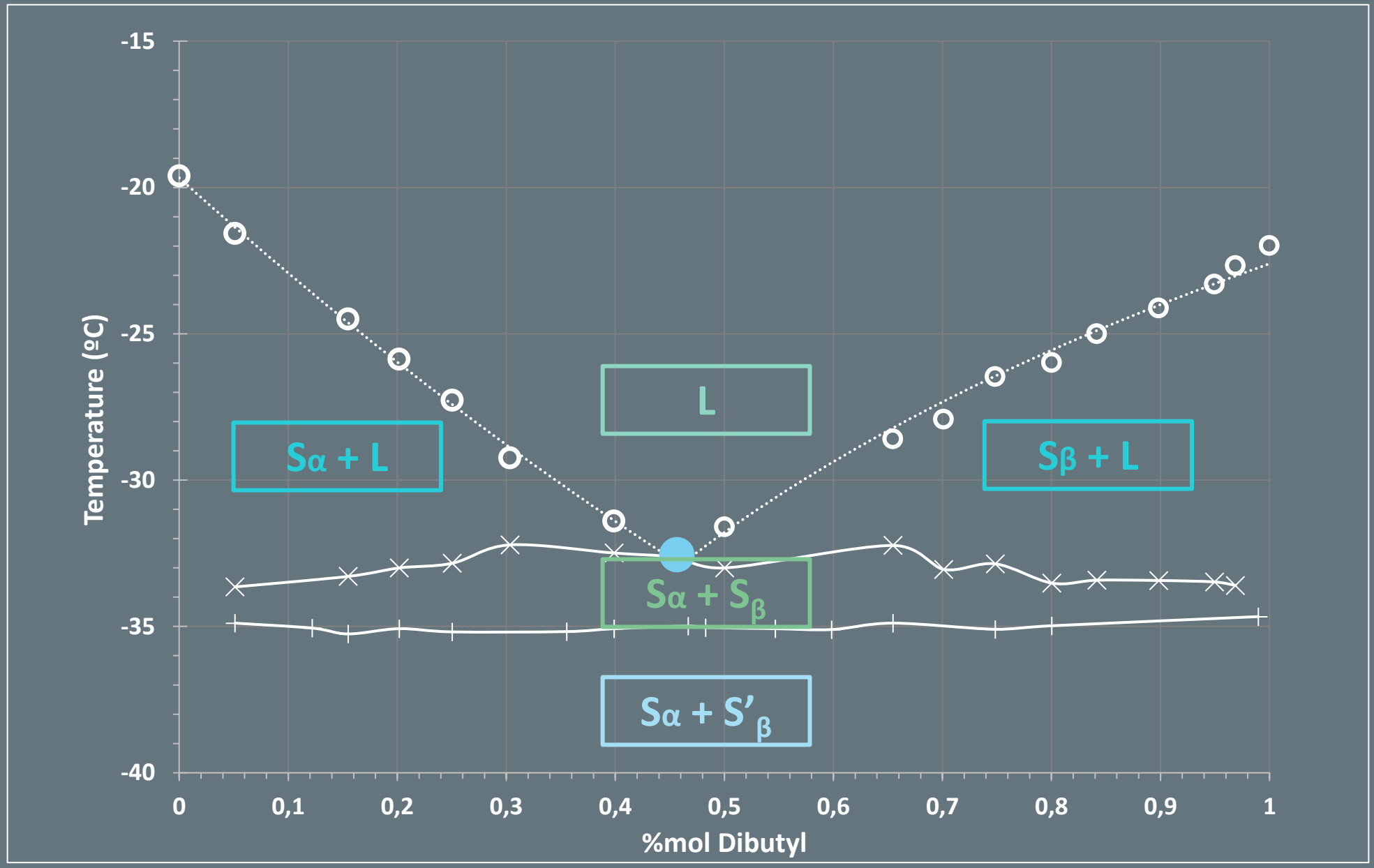
New Results

Eutectic System

45.8%mol Dibutyl
T_e= -32.7 ºC
ΔH_f = 132.4 J/g

Polymorphism

Binary Phase Diagram



Binary Phase Diagram

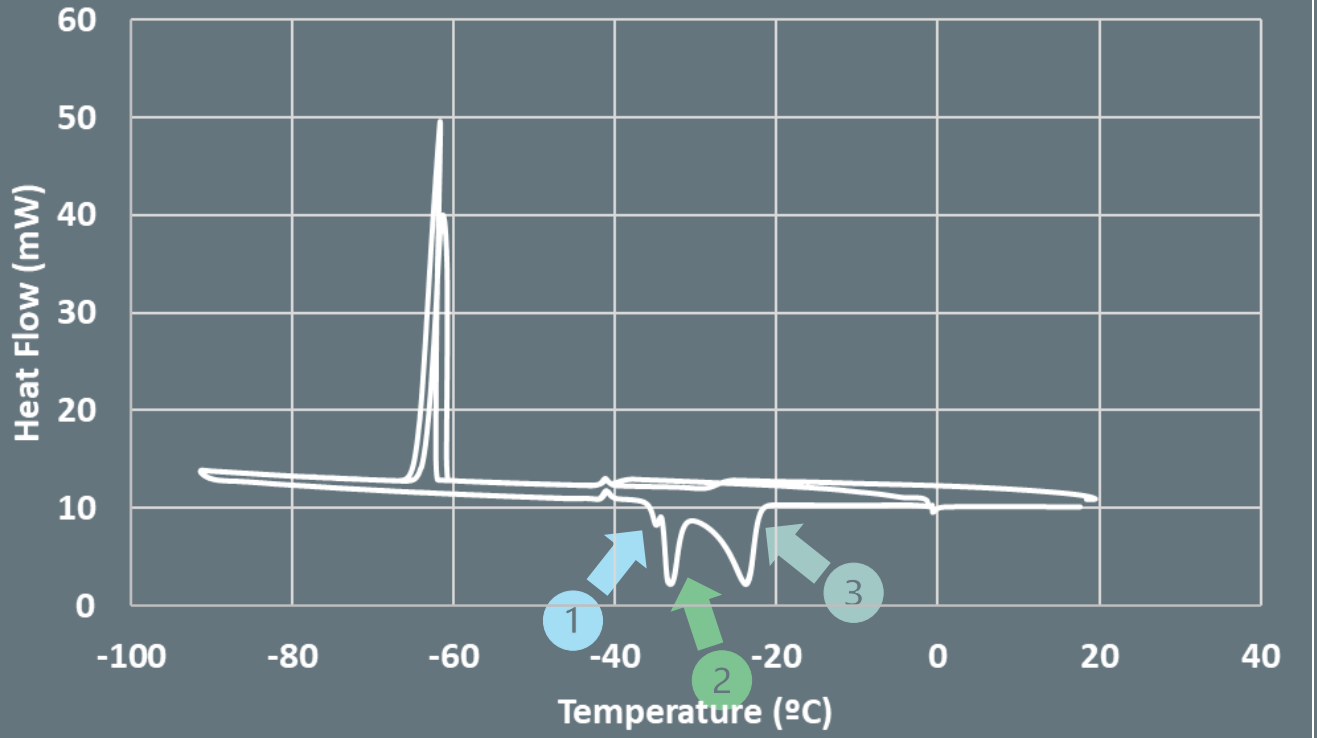


Figure 2 – Experimental results obtained by DSC for 10%mol in Dibutyl adipate.

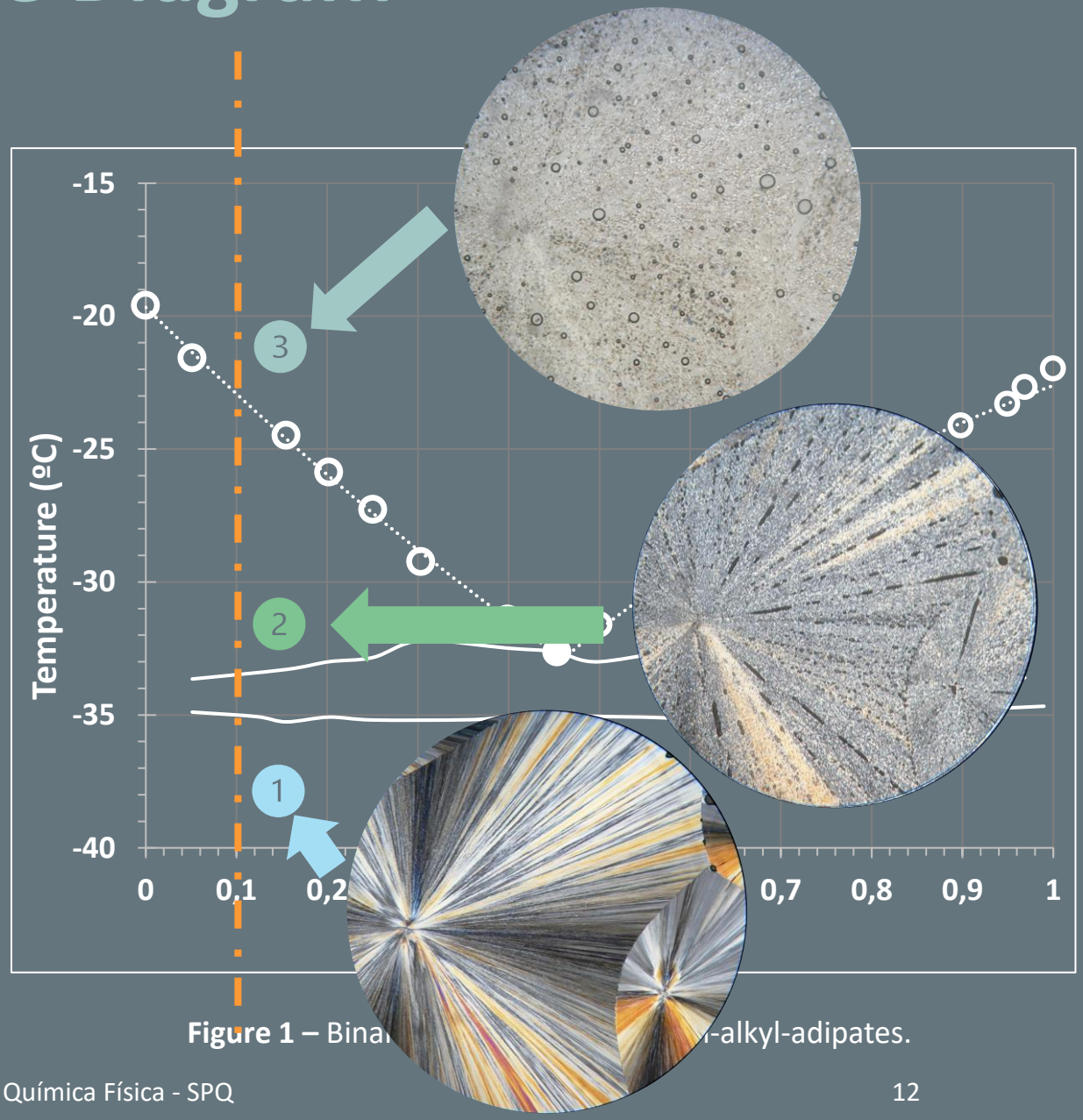


Figure 1 – Bina -alkyl-adipates.

Binary Phase Diagram

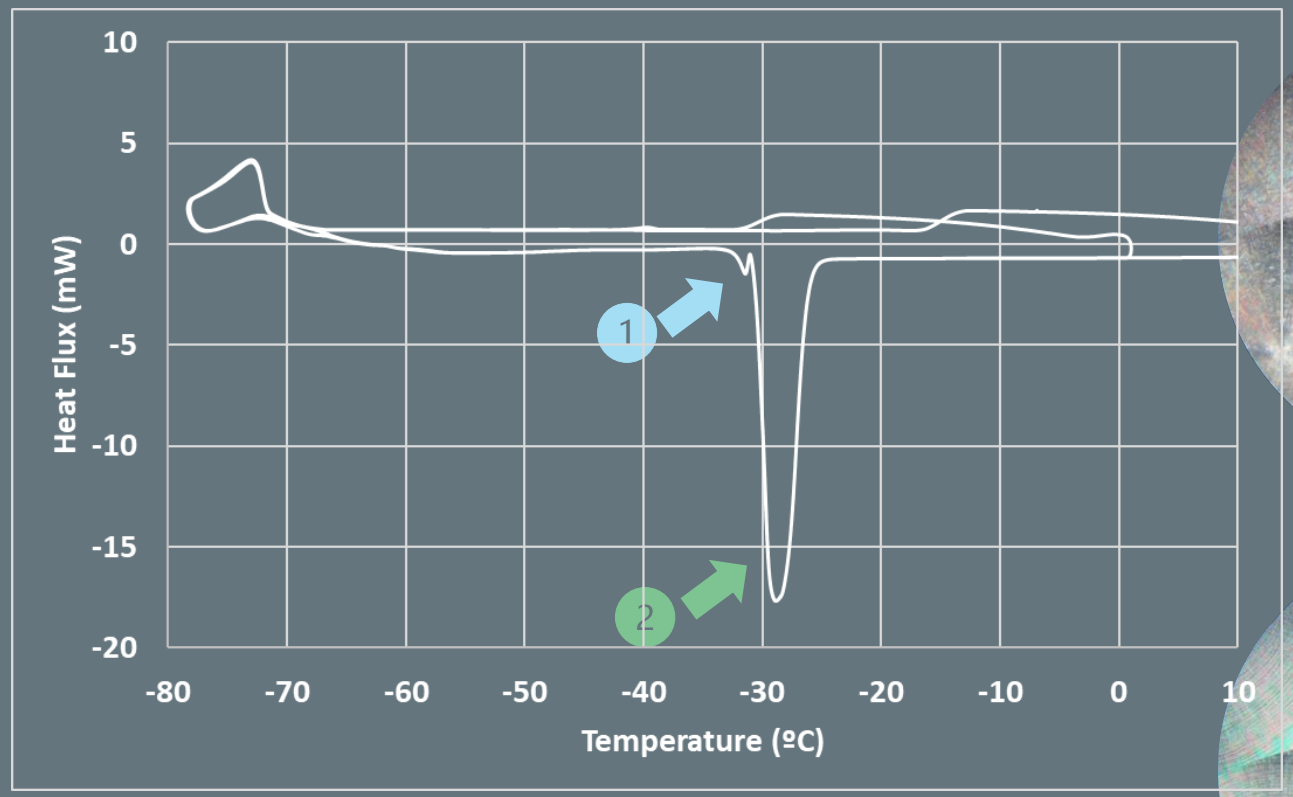
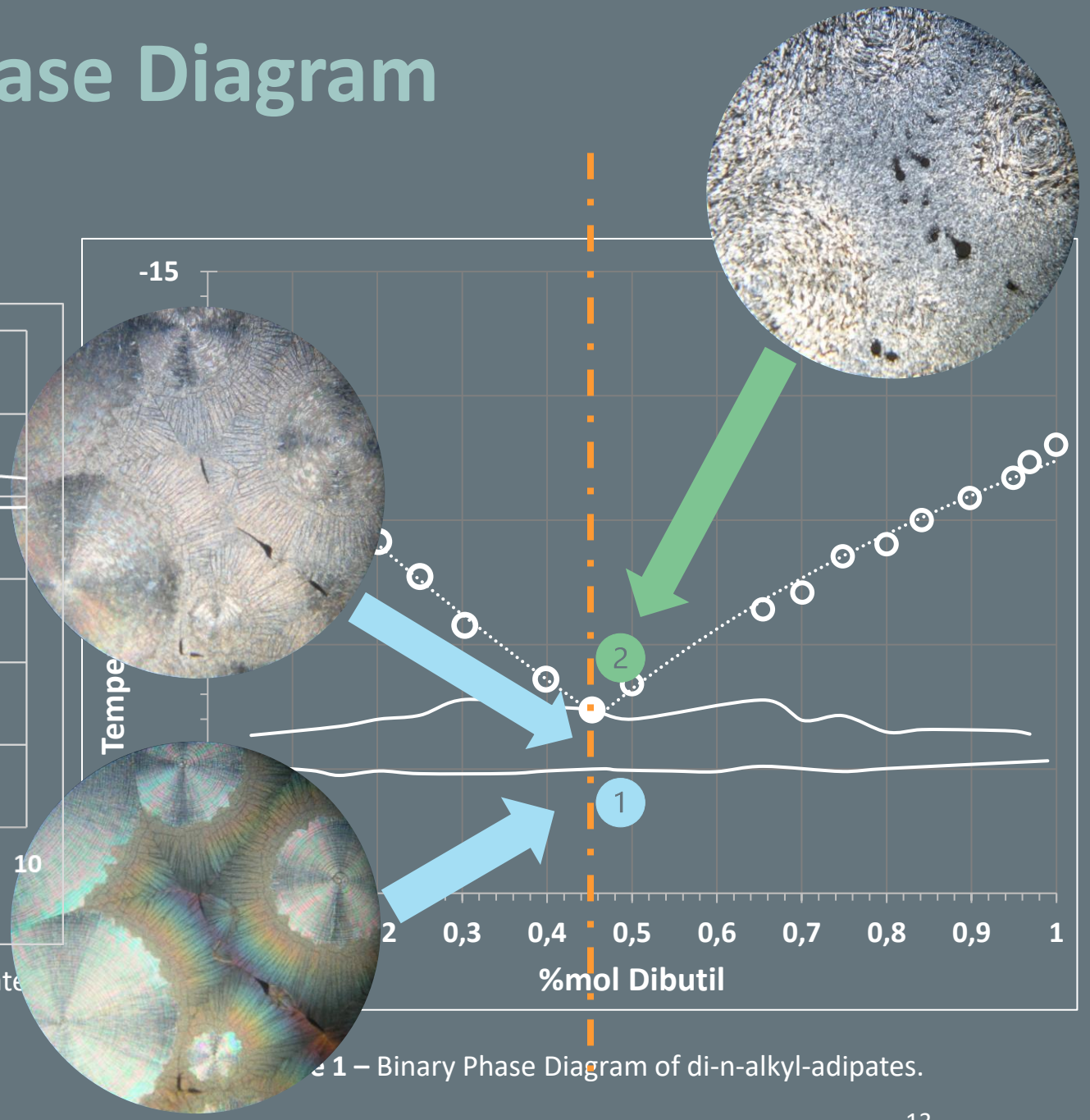


Figure 3 – Experimental results obtained by DSC for 45%mol in Dibutyl adipate



e 1 – Binary Phase Diagram of di-n-alkyl-adipates.

Raman Spectroscopy

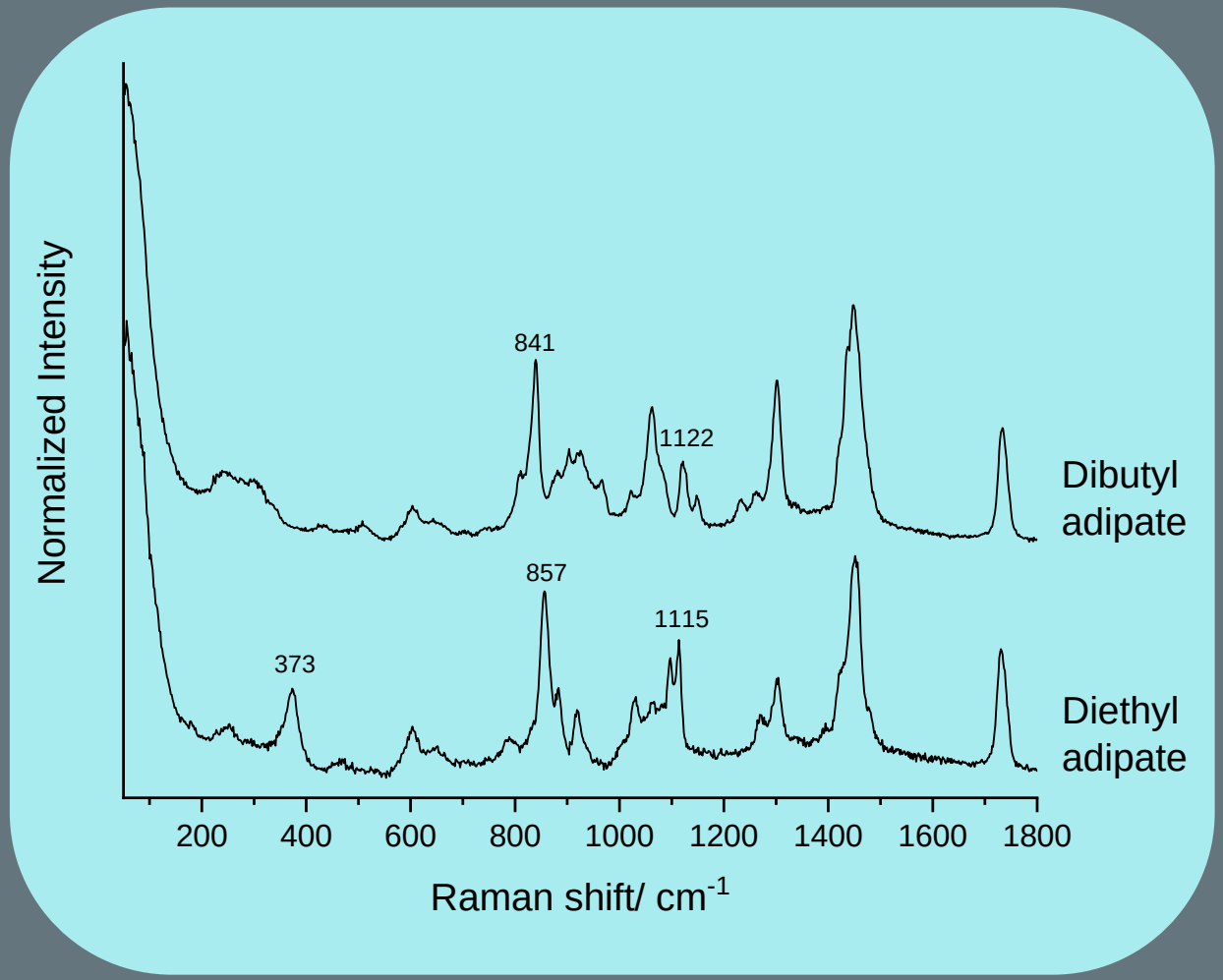


Figure 4 – Raman spectra of room-temperature liquid samples of diethyl adipate and dibutyl adipate.

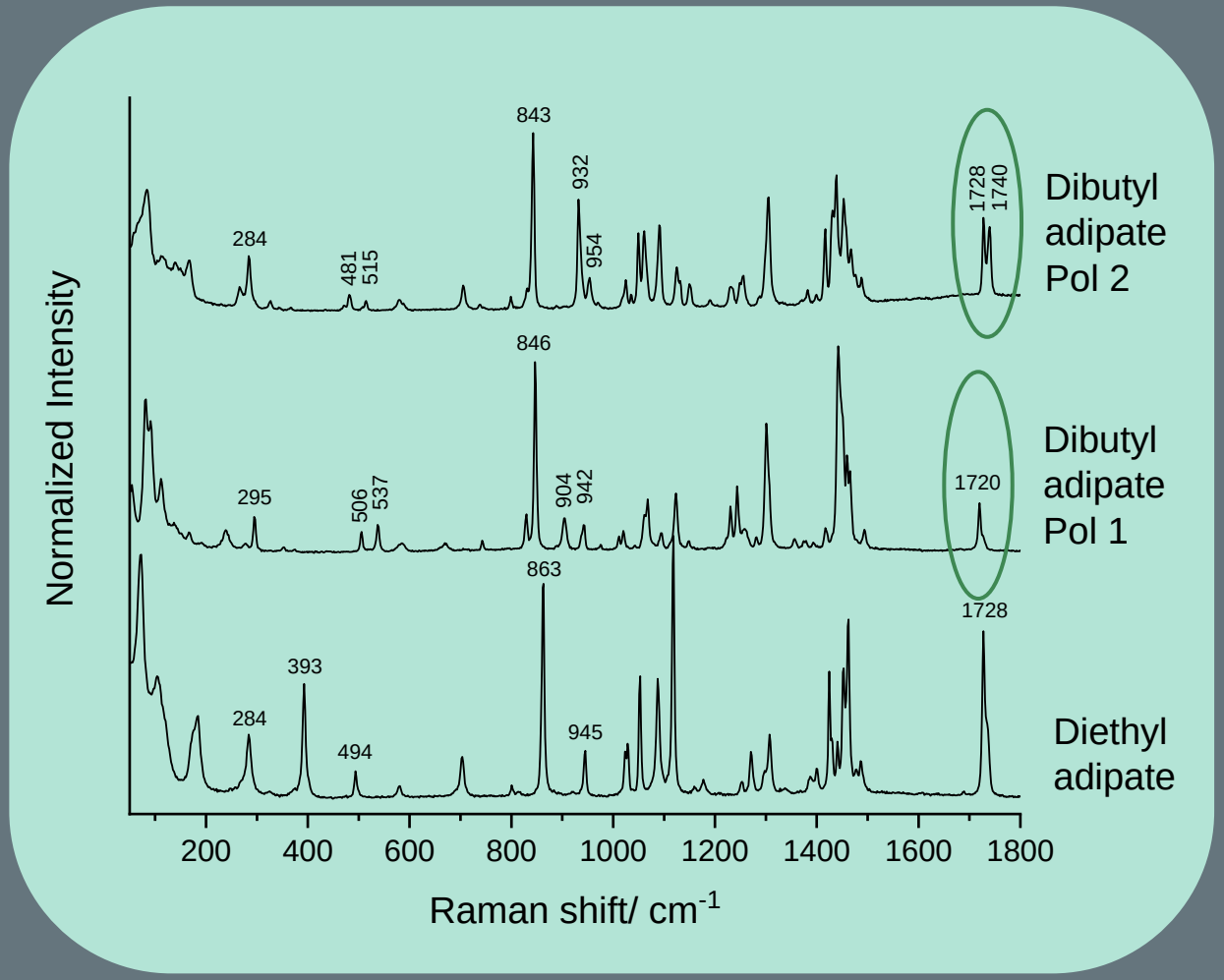


Figure 5 – Raman spectra of the solid-state pure diethyl adipate and dibutyl adipate samples.

Raman Spectroscopy

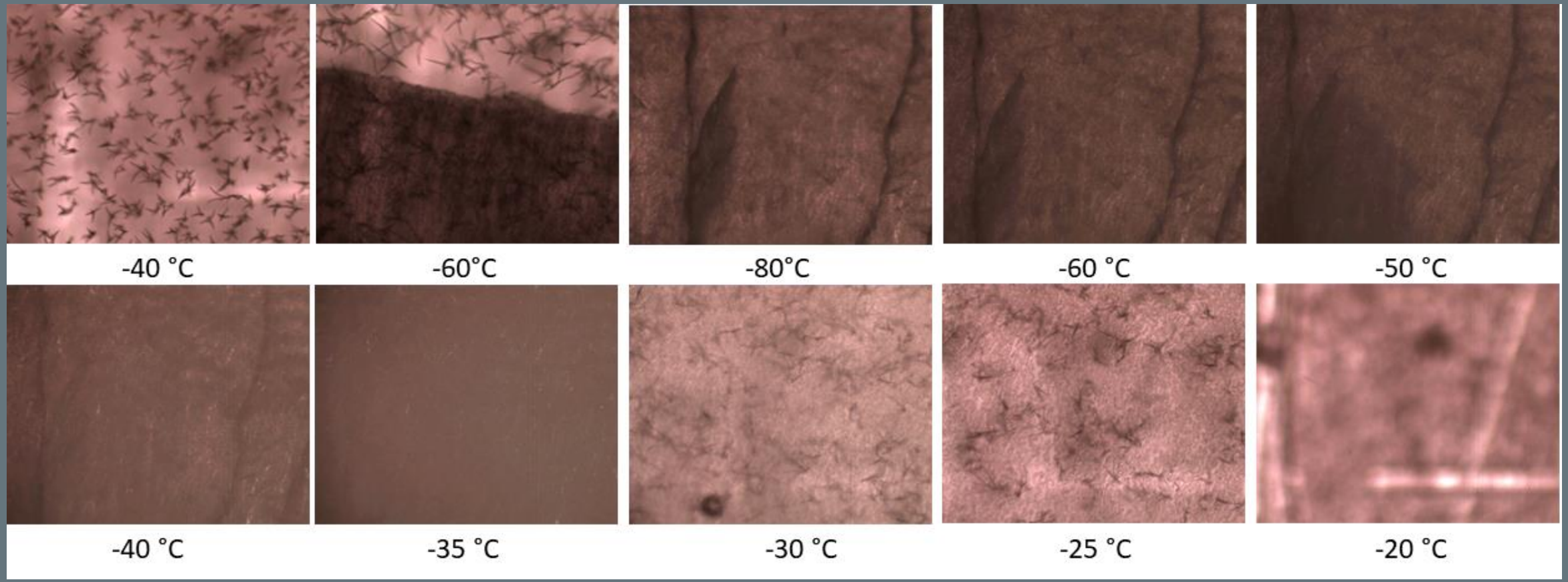


Figure 6 – 80:20 diethyl adipate:dibutyl adipate mixture photographs collected during the temperature-variation Raman spectroscopy experiment, with 10x magnification.

Conclusions

Binary system:
Diethyl + Dibutyl adipates

Eutectic Point:
Te = -32.7 ºC
ΔH_f = 132.4 J/g

Polymorphism

Hot Stage Microscopy
DSC
Raman Spectroscopy

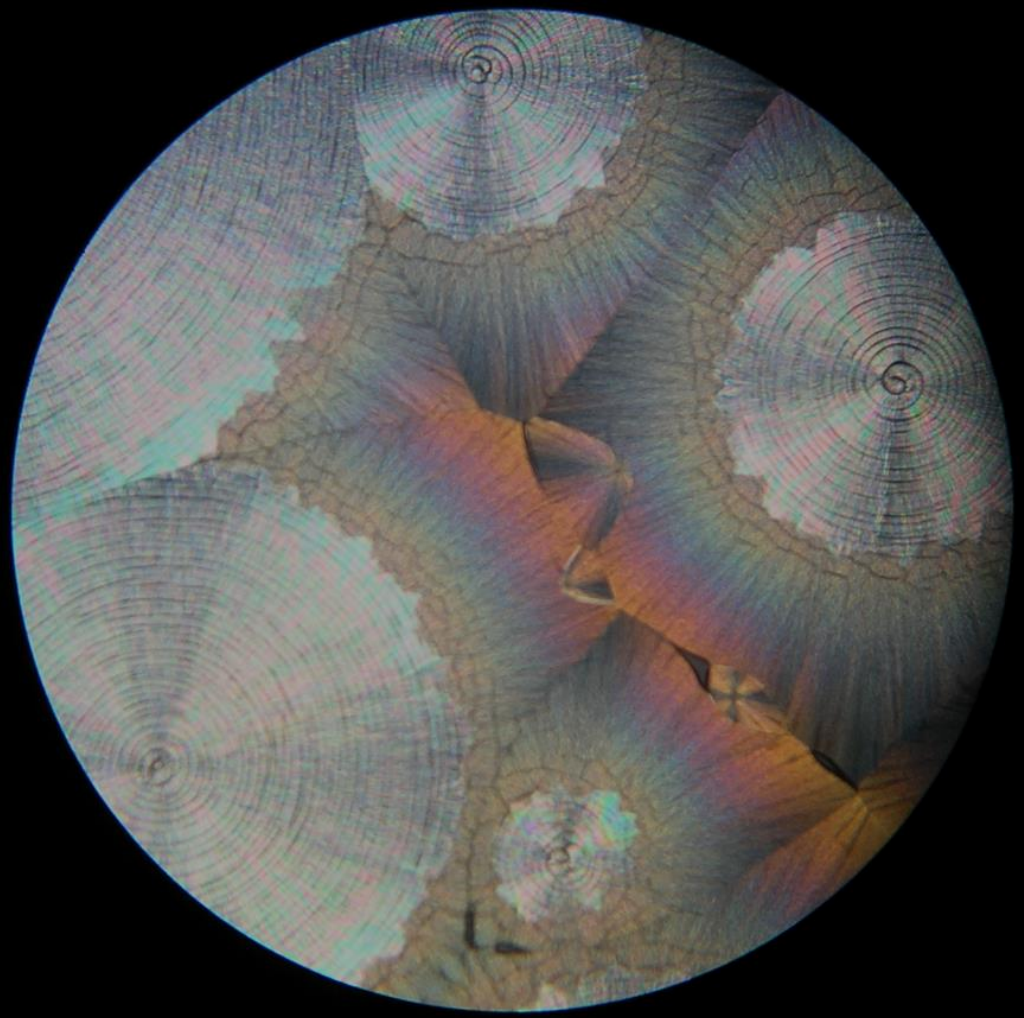
Good Potential for Thermal Energy Storage

3. Future Work

To do next:

Measurements of Thermophysical Properties

Investigation of new PCMs for Low Temperature Energy Storage



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