

# Polymer Education in Japan

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# Tokyo, the Capital of Japan



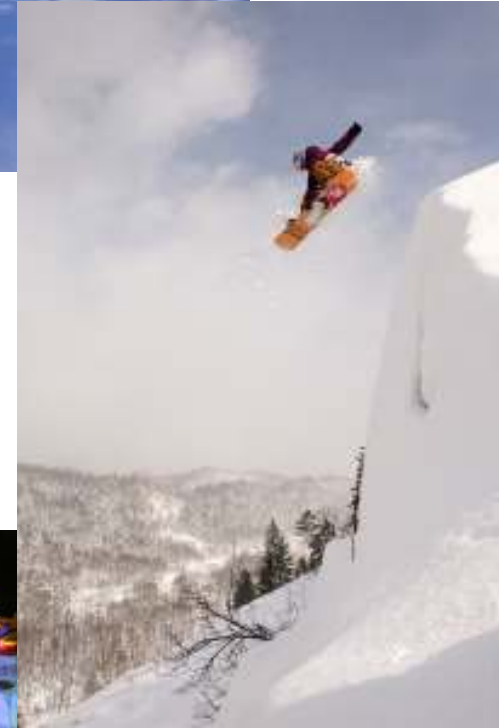


Sapporo

Hokkaido Island

Hon-shu Island

Tokyo (the capital)



# City of Sapporo







Catalysis Research Center (CRC)



**Undergraduate teaching**

Department of Chemistry,  
School of Science, Hokkaido University

**Graduate teaching**

Graduate School of Chemical Sciences  
and Engineering, Hokkaido University

## Japan's Education System

The schooling years are segmented along the lines of (3)-6-3-3-4:

- 3 years of Kindergarten (age 3-6)
- **6 years of elementary school (age 7-12) compulsory**
- **3 years of junior high school (age 13-15) compulsory**
- 3 years of high school (age 16-18)
- 4 years of university (age 19-22)
- 5 years of graduate School (age 22-)
  - 2 years of master course + 3 years of PhD course  
(or 5 years of PhD course)



Kindergarten



Primary school ~ high school



University/graduate school

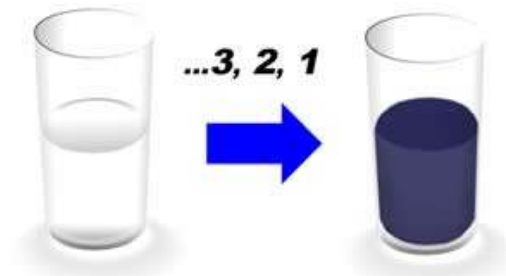


6 years of elementary school (age 7-12)  
3 years of junior high school (age 13-15) compulsory

### Encounter with polymers

**“Iodo-starch reaction” in science lab class**

(The term, “polymer”, may be first introduced to children, but no details are taught.)



**3 years of high school (age 16-18)**

**Introduction of the concept of polymer as advanced contents in chemistry class**

The concepts of “Polymer” and “Polymerization” are taught in chemistry class but not in detail. “Polymer structure and polymeric materials” (Nylon, PET etc) are treated as optional subjects in teaching.



**Chem I (290 pages):**



**Chem II (316 pages):**

## 4 years of university (age 19-22)

### Teaching details of polymerization, characterization, and properties

- 1) Polymer chemistry is taught as an independent, compulsory subject.
- 2) Otherwise, polymer chemistry is taught as an optional, rather unimportant part in Organic Chemistry class.

## 4 years of university (age 19-22): Lab class

Lab classes are mandatory for chemistry-major students in 2<sup>nd</sup> and 3<sup>rd</sup> school year of university (age 20-21)



Polymer chemistry is often **NOT** included in lab class teaching.

**Graduate School (2 years of master course and 3 years for PhD course)**

**Polymer science education as a completely optional subject**

**Class:** Polymer chemistry and related subjects are optional (elective).



**Lab (research):** Students are assigned to research groups in the 4<sup>th</sup> year. **Students in non-polymer groups do not learn about polymers any more.**



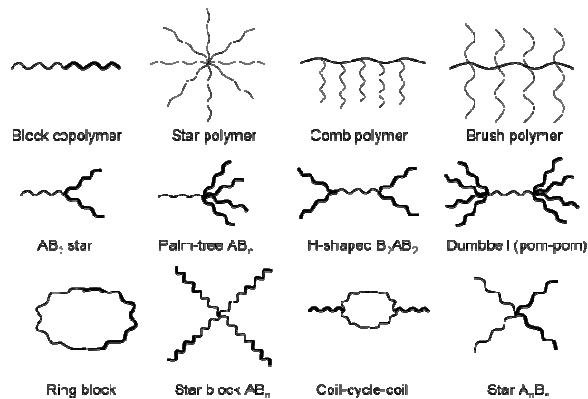
**Fact:** Around 90% of new graduates get a job in companies that make and/or sell polymers or do business related to polymers.

## Education in industries

Industries teach new employees having different academic backgrounds (details are never disclosed)

Often-heard complaints/issues:

- New employees from non-polymer research groups often know almost nothing about polymers; they have to start from the scratch.
- Polymer processing (extrusion, molding...) is hardly or not at all taught but it is what many company employee do for salary.



Polymers



Extrusion image

## Issues and possible solutions

6 years of elementary school (age 7-12)

3 years of junior high school (age 13-15)

3 years of high school (age 16-18)

} Education contents are decided by MEXT.

→ The mission is to get into a good college.  
(Entrance exam)

De we need to teach more?

⇒ Irregular classes and lab experiences that are not included in school curriculum

4 years of university (age 19-22)

Graduate School

De we need to change curriculum?

⇒ Internship opportunities to experience real-world polymer jobs.  
Students/companies can save time for job interviews.

Keep teaching non-polymer research group students and give them chances at least to get familiarized with polymers.

## Another issue in graduate school:

Is just Master's degree good enough? Or do they need PhD?

### Industry-side opinions (...imagined)

- New employees having PhD may cause problems from a view of “uniformity” and “seniority by length of service”, important social cultures of Japan.
- Hiring older, brainwashed, narrow-scoped PhD students is inconvenient.



uniformity



seniority by length of service

### Professor-side opinions

- Graduate schools are short of PhD students.
- We cannot convince students to proceed to PhD course since there is no salary benefit.



## Changes are happening:

**Mr. Toshikage Asakura** (48, A PhD student, an employee of BASF, Japan)



- Obtained Master's degree from Osaka University in 1990
- Works as a R&D manager, speak with overseas industry scientists.

“Having no PhD is awkward when I discuss with others having PhD abroad. My having no PhD sometimes causes real problem in business.”

## 2020 Olympic games in Tokyo, Japan

- We are short of people.
- The labor shortage is and will be made up more and more by foreign people.
- We finally became completely aware of these facts. The labor shortage will eventually occur even in R&D; we will need to accept an international culture in which **“A professional scientist has PhD”**.

## Prefectural-level efforts

“Science Educational Center attached to Hokkaido Education Research Institute”



### 1) Teaching high school and junior high school teachers

“Raising the teaching power” seminar

6 workshops/seminars were held with 252 attendees (teachers) in 2013.

### 2) Family science class

Children and parents join lab classes, 24 (summer) and 36 (winter) families were invited to the institute in 2013.

### 3) “Movable science class”

Teaching children living in distant towns.



## Personal-level efforts:

“Science I (Eye)”, A group of seven retired professors in Hokkaido

### DR. MASAO TOKUDA

*Professor Emeritus, Hokkaido University*

Chairman, Ishikari City Board of Education

Former Chairman, Ishikari Citizen's College

Member, Science I

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## 1) Monthly lab class for junior high and elementary school students

\*Lab space offered from Hokkaido Univ.

\*\*Money for expendables donated by the Science Eye members (pro bono).

## 2) Visit to schools

The members visit on request high schools, junior high schools, elementary schools, and kindergartens to give lectures and demonstrate science experiments.

## Summary

Overview of Japan's polymer education contents

### Issues

- Education of non-polymer research group students
- Polymer processing education
- Master or PhD? (Employment system/culture)