



UNIVERZITET U NOVOM SADU
FAKULTET TEHNIČKIH NAUKA
DEPARTMAN ZA PROIZVODNO MAŠINSTVO



STUDIJSKI MODUL

SAVREMENE

TEHNOLOGIJE

OBLIKOVANJA PLASTIKE

PLASTICS ARE EVERYWHERE!



You'll find them in:

- transport
- packaging
- building and construction
- electrical and electronics
- medicine
- sports
- agriculture, etc.



Ford Looks to Mother Nature to Create Greener, Lighter Plastics



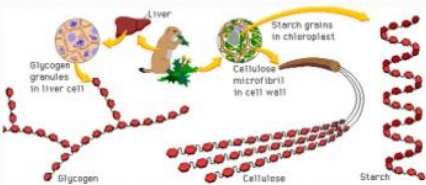
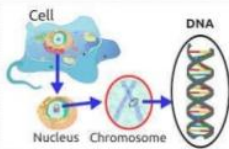
HELPING TO ADVANCE MEDICINE

Thanks to plastics:

- people live healthier, longer and more fulfilling lives than at any time in history
- medical breakthroughs considered unthinkable 50 years ago are now possible.



Natural polymers



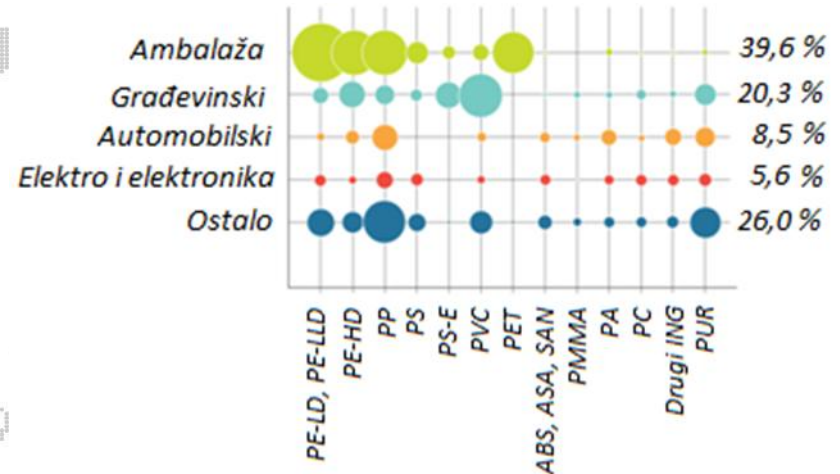
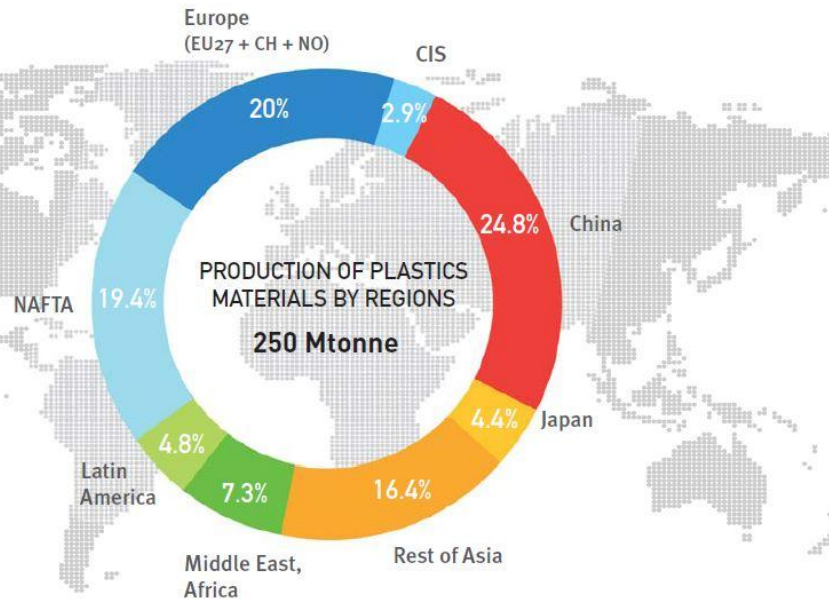
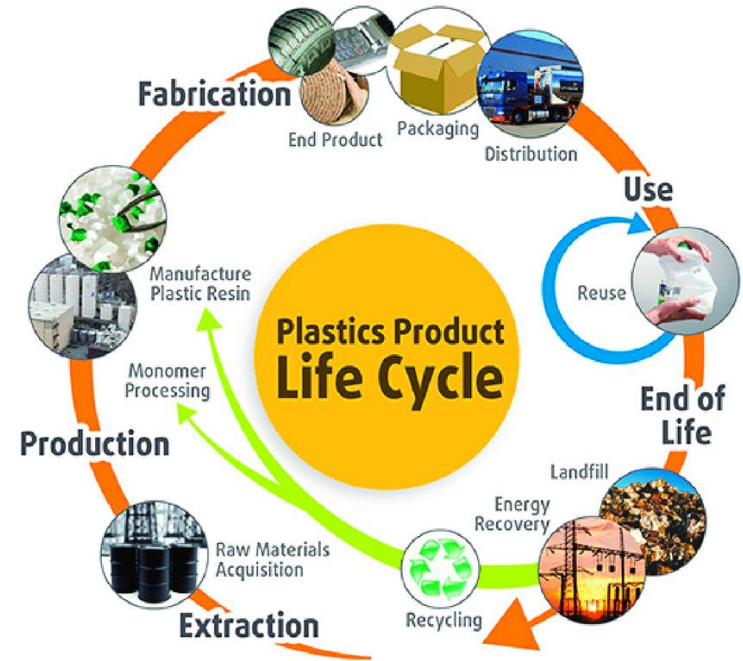
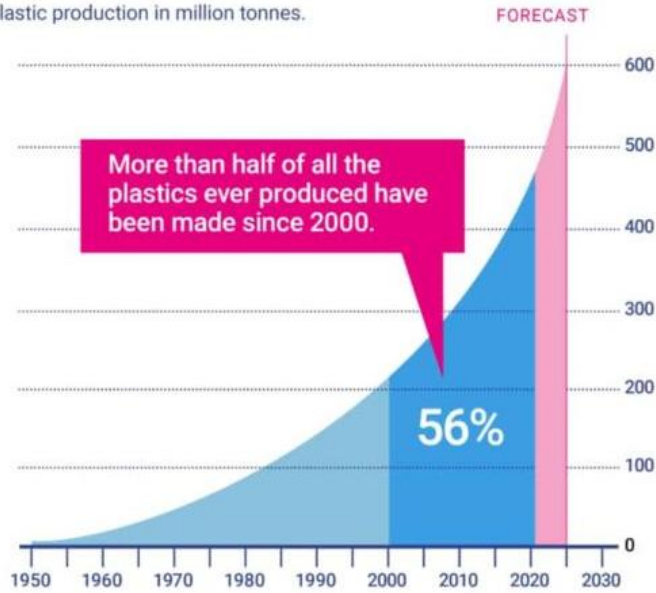
Cotton: A Natural Polymer

Synthetic polymers for demand ...

POTROŠNJA POLIMERNIH MATERIJALA U SVETU

PRODUCTION OF PLASTIC

Global annual plastic production in million tonnes.



Kućna elektronika



Ambalaža:

- Sitna ambalaža (boce, tube, kantice ...)
- Krupna ambalaža (burad, kante, rezervoari....)

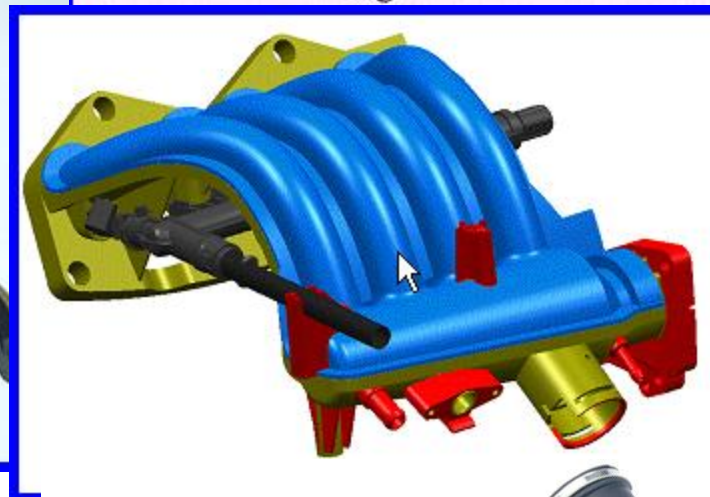
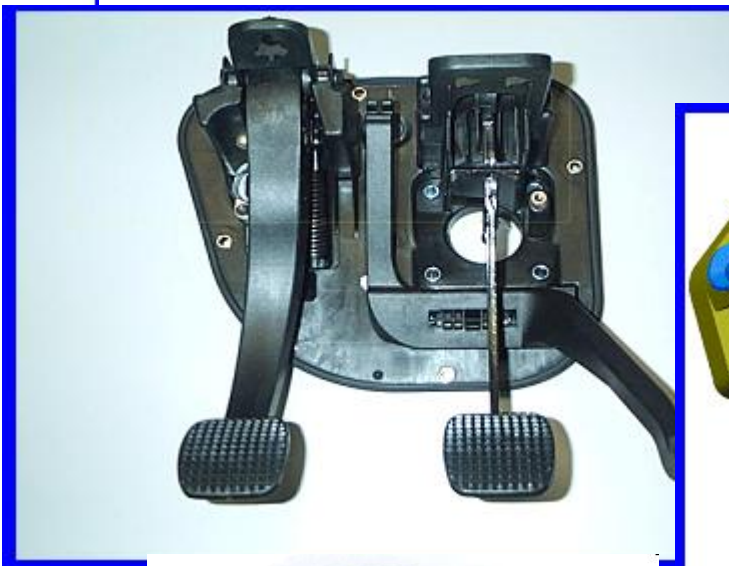


Gradževinsko-konstrukcioni materijali

- *Profili*
- *Cevi*
- *Zidne obloge*
- *Podne obloge*
- *Stolarija*

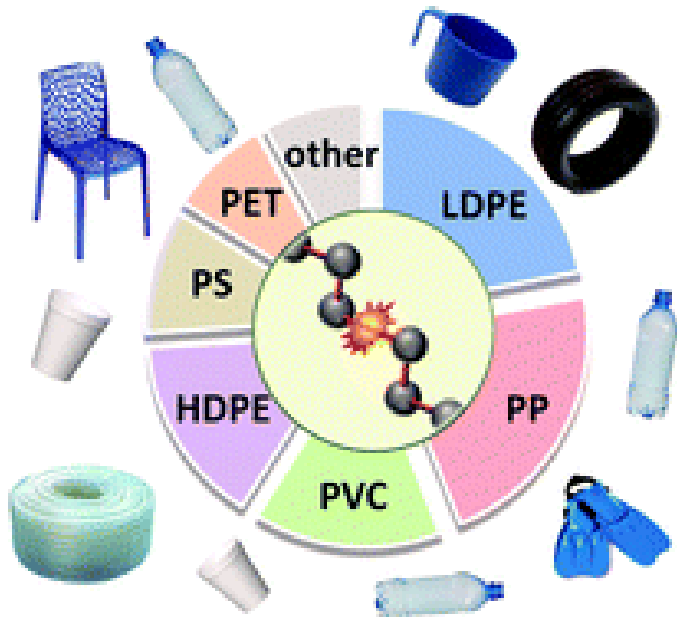
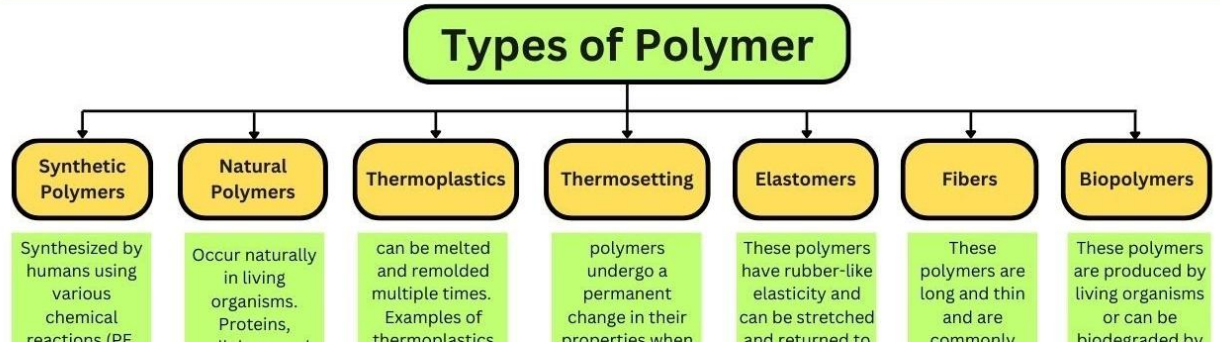


Auto-Industrija

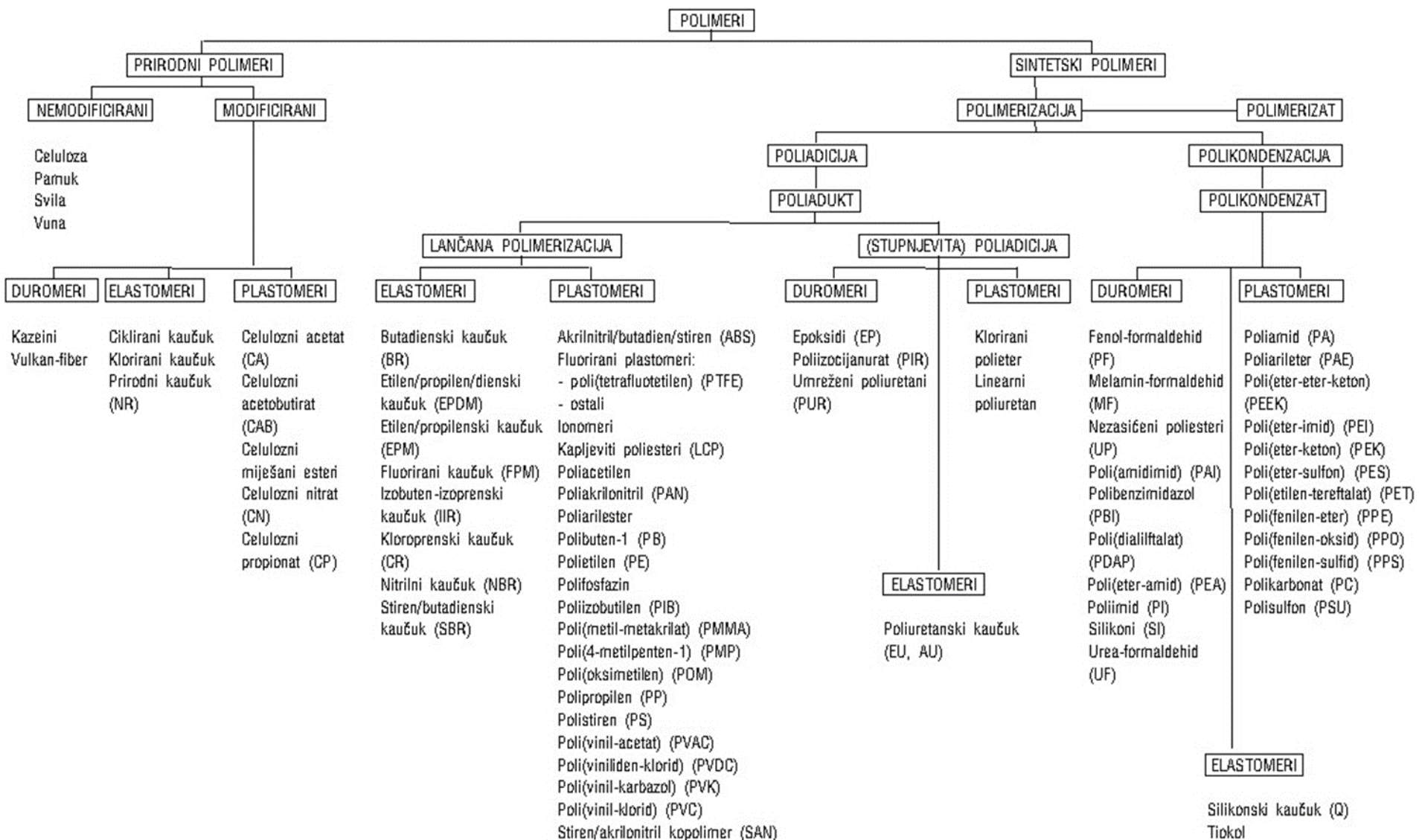


predmet: Svojstva i primena plastičnih materijala





What is polymer and different types of polymers

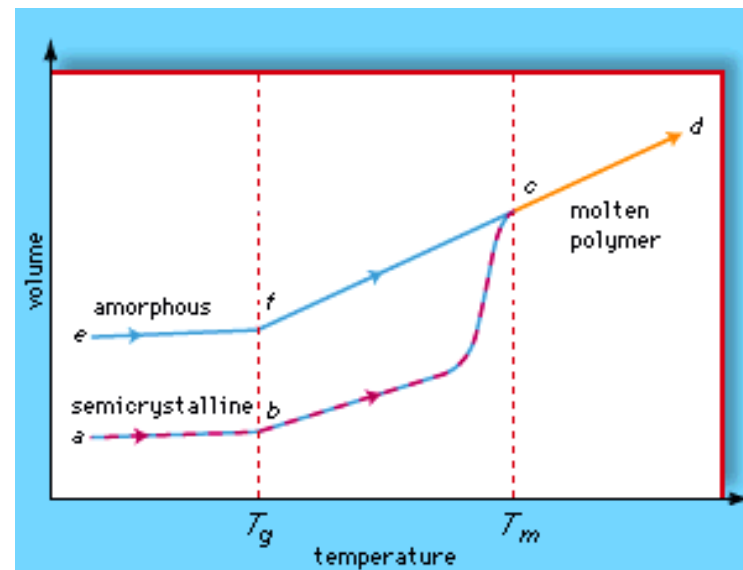
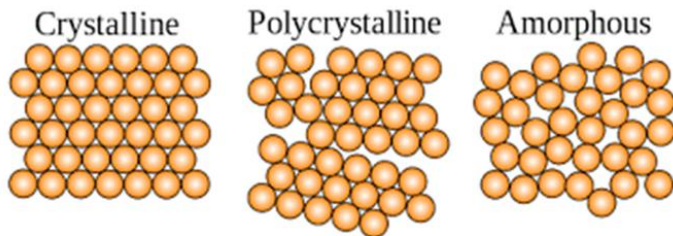


predmet: Svojstva i primena plastičnih materijala



predmet: Fizička i fazna stanja polimera

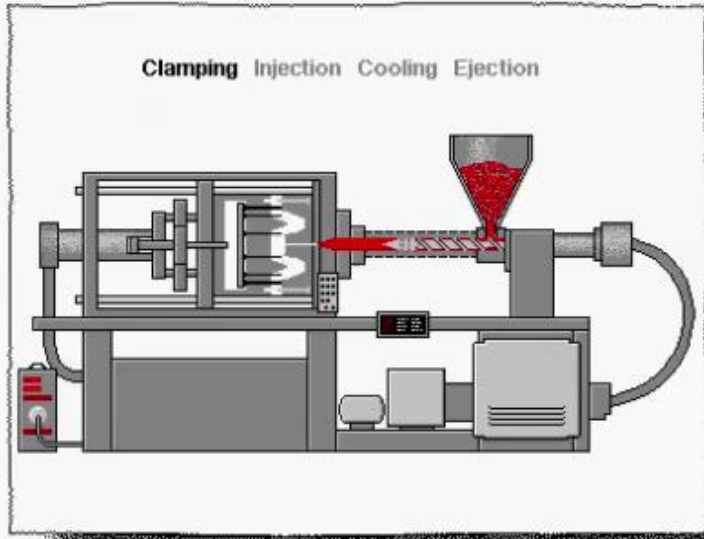
GRADA	 linearna Van der Valsove veze	 razgranata imaju i bočne veze	 umrežena kovalentno vezani lanci i poprečno um- reženi	 prostorna mreža 3D mreža
Glavne grupe	Termoplasti		Elastomeri	Duromeri
Struktura	kristalna	amorfna	amorfna	amorfna



predmet: Tehnologije oblikovanja plastike

- KONTINUIRANI POSTUPCI

- CIKLIČKI POSTUPCI



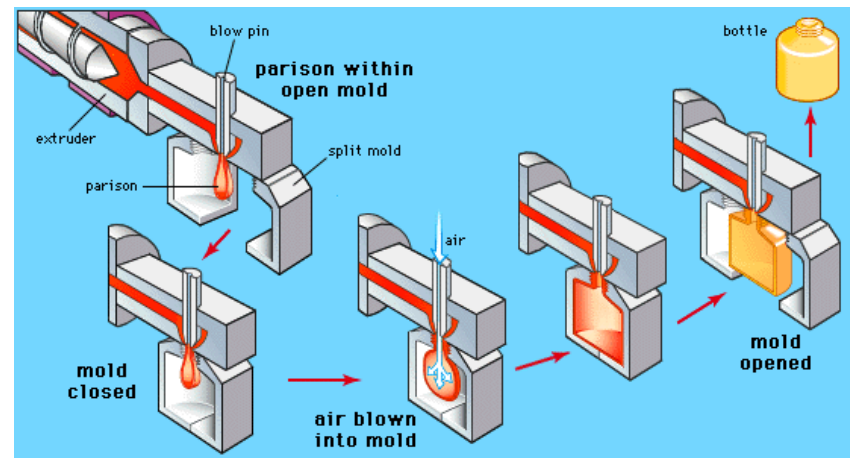
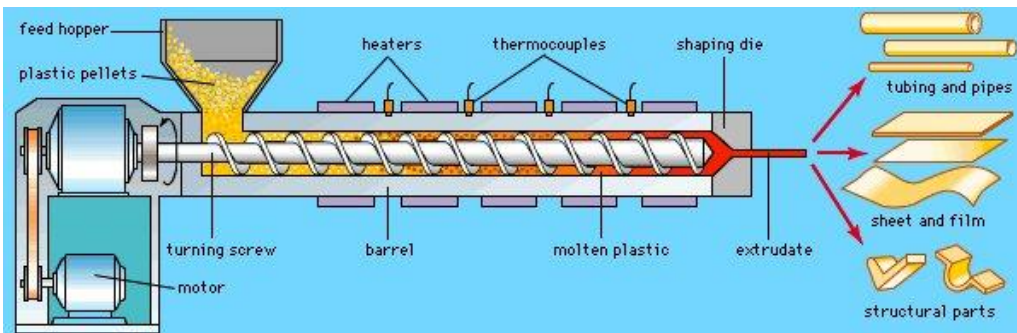
Plastic processing

Raw is pellets or powder

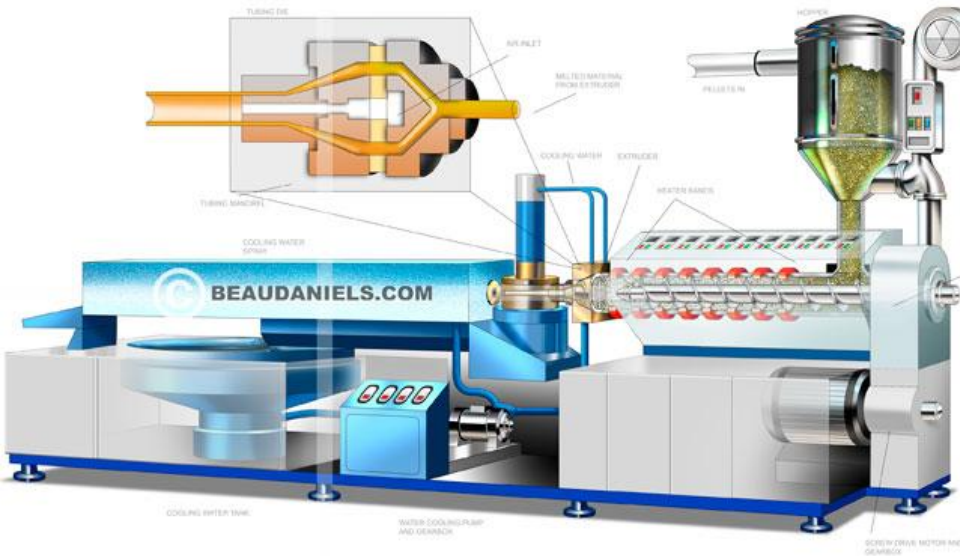
Examples of additives on master batch :

- filler
- Softeners
- Reinforcing agents
- Flame retardants
- Blowing agents
- Colorants
- UV degradants

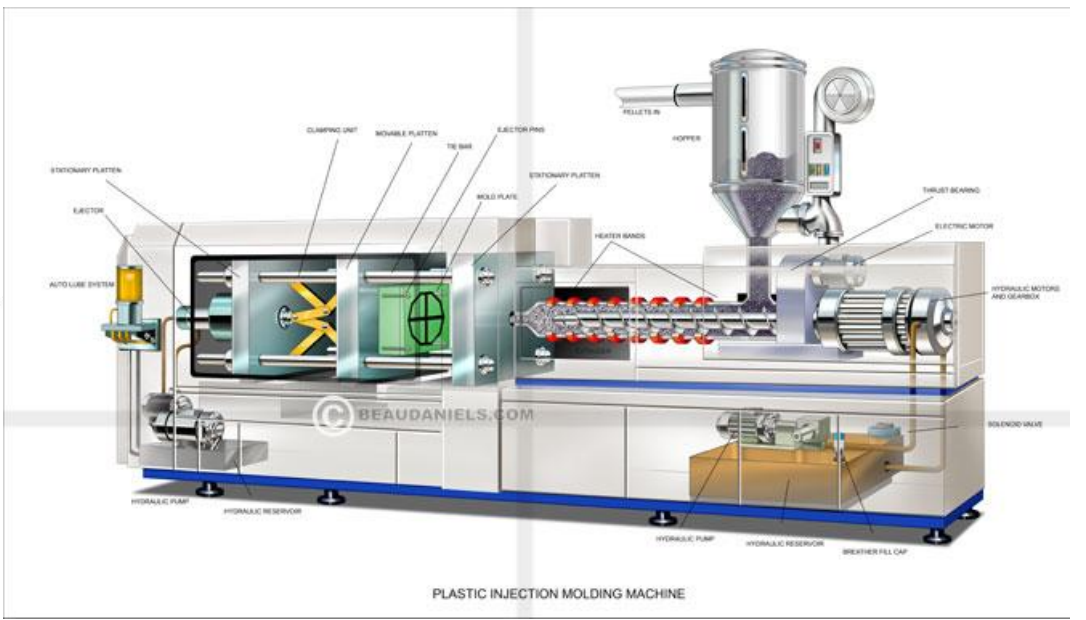
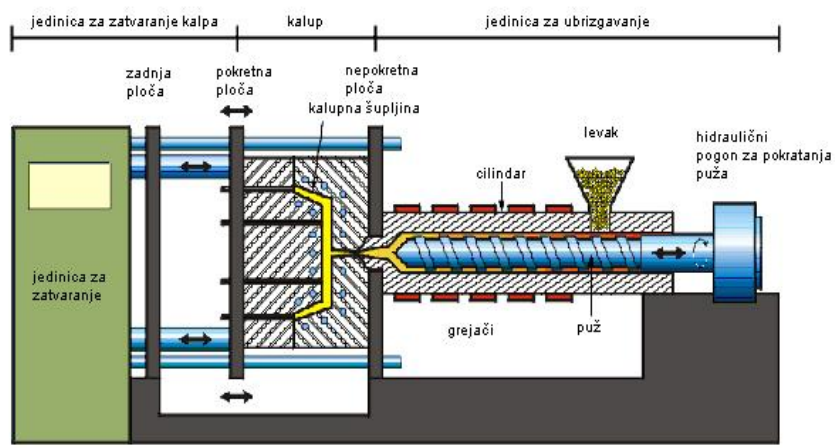
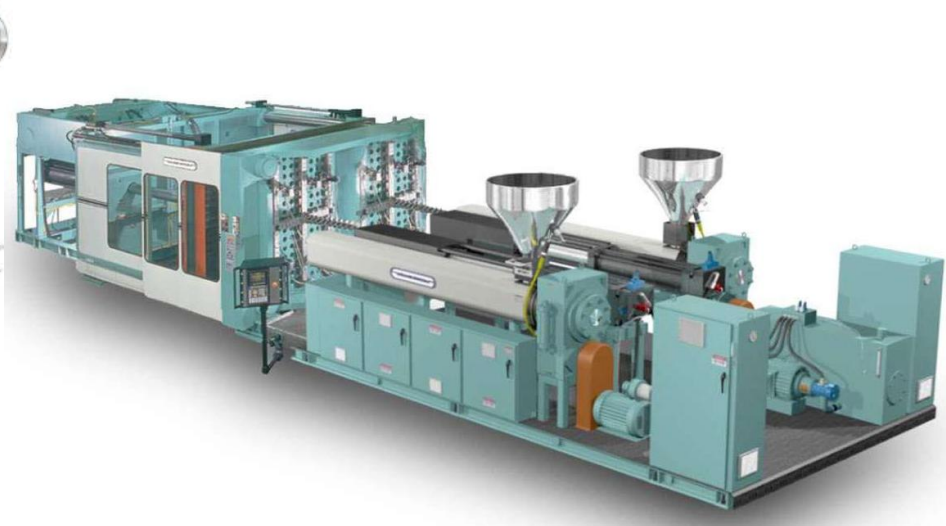
The image shows various additives used in plastic processing, including filler, softeners, reinforcing agents, flame retardants, blowing agents, colorants, and UV degradants. Each additive is shown in a small image with its name below it.



predmet: Mašine i uređaji za preradu plastike



PLASTIC EXTRUSION MOLDING MACHINE

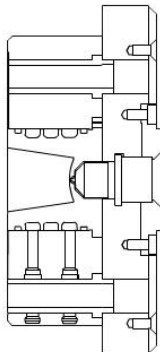
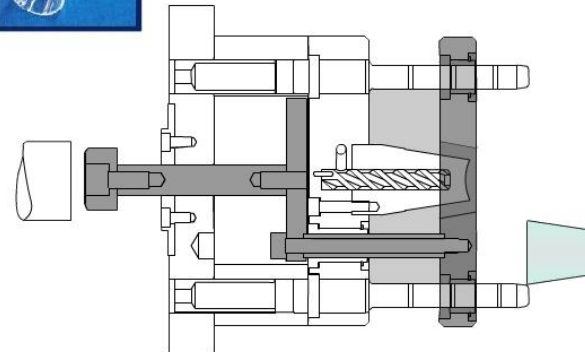
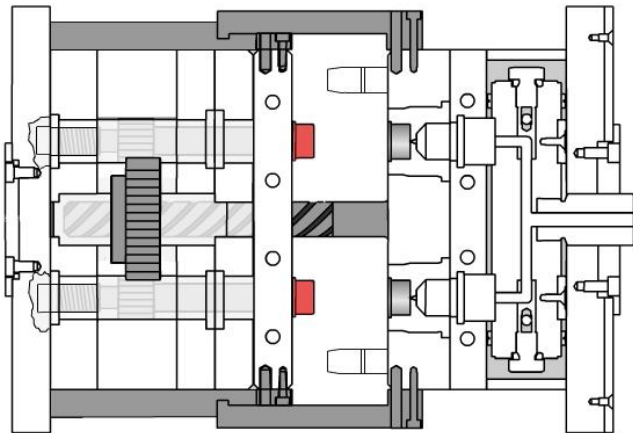
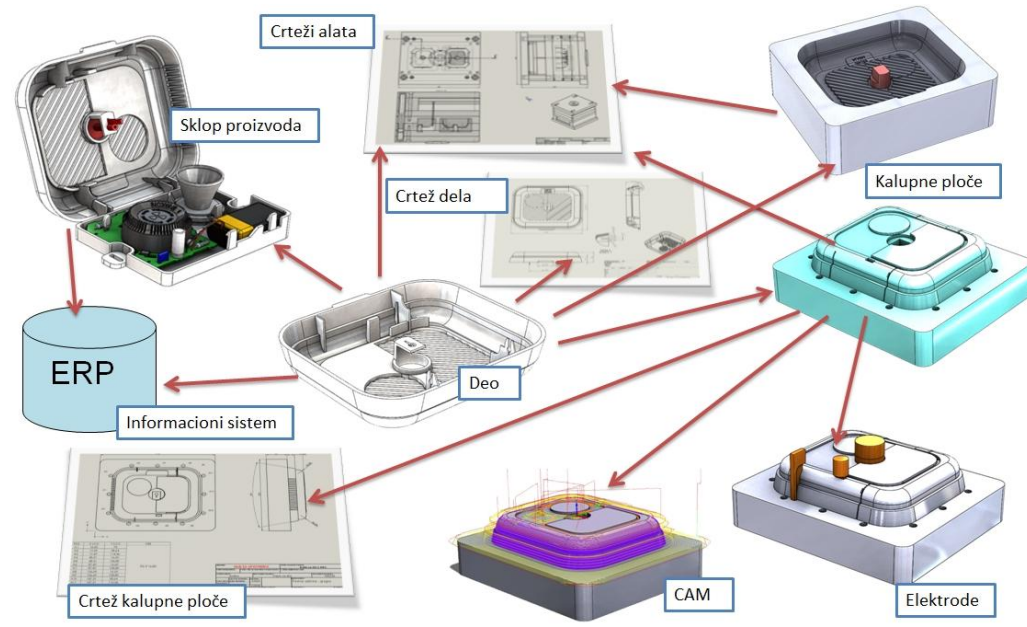
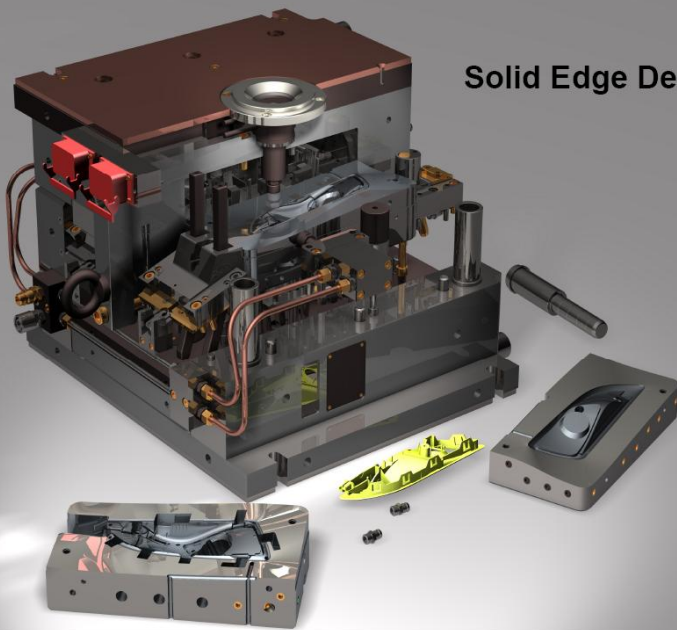


PLASTIC INJECTION MOLDING MACHINE

predmet: Projektovanje alata za plastiku

Alat za oblikovanje retrovizora

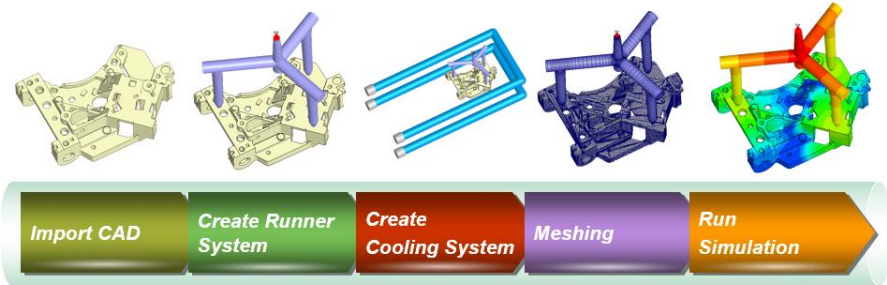
Solid Edge Design



SOFTVERSKI PAKETI

1. Programski paketi za automatizovano projektovanje (CAD modelovanje alata i delova):

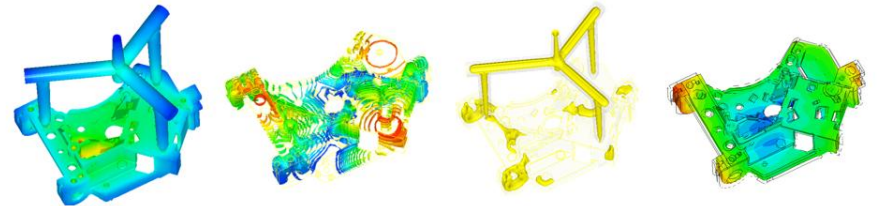
- AutoCad/Mechanical
- Pro/Engineer
- Catia
- UGS NX
- SolidEdge...



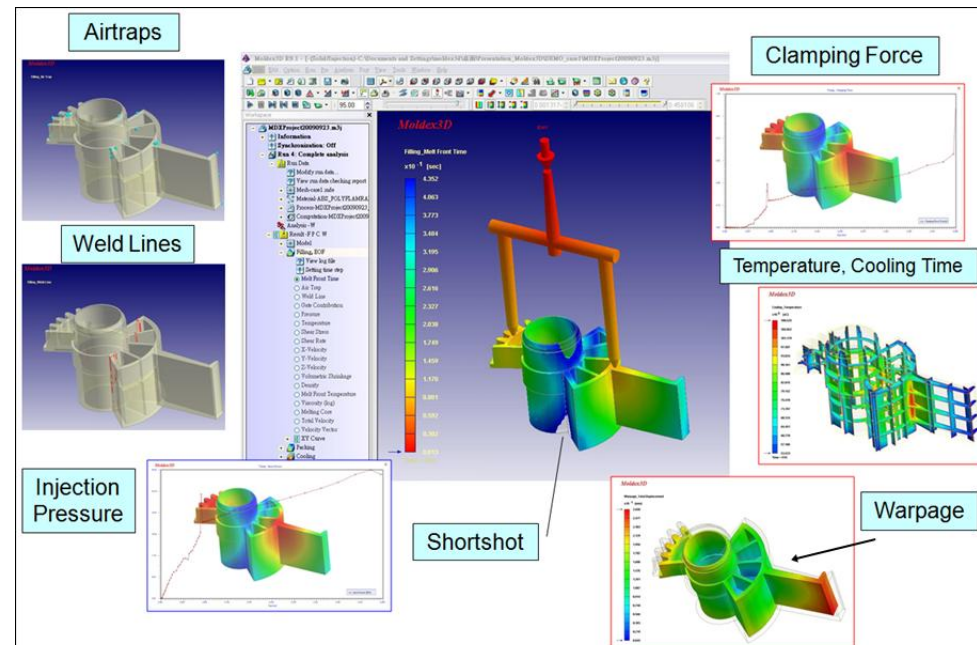
2. Softverski paket za simulaciju procesa

oblikovanja (CAE analiza) – MOLDEX3D

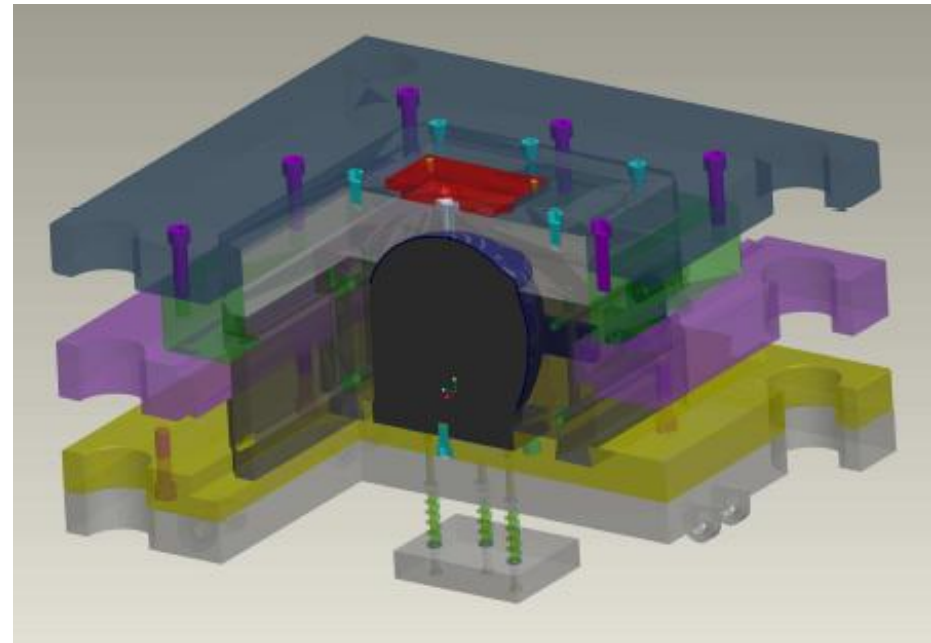
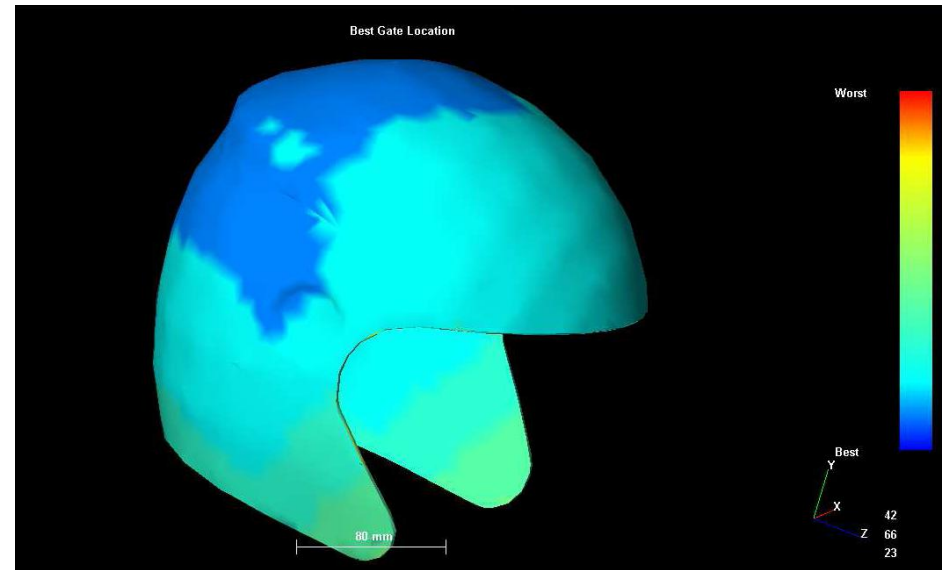
- Provera mesta ubrizgavanja
- Linije spajanja
- Kvalitet otpreska
- Analiza napona
- Toplotna analiza
- Tečenje materijala
- Greške



3. Softveri za CAM, CAPP



... jedan Master rad iz predmeta Projektovanje alata za plastiku



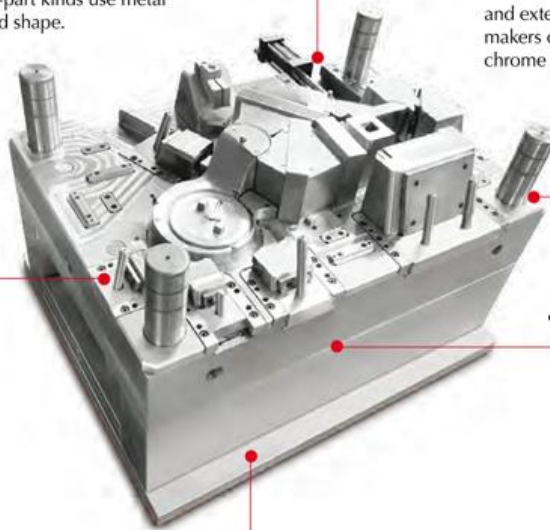
predmet: Termička obrada savremenih alata

Typical features

- **Construction:** Suppliers make independent parts that can be integrated into a seamless whole for products such as showers. Single-part kinds use metal and adopt a cuboid shape.

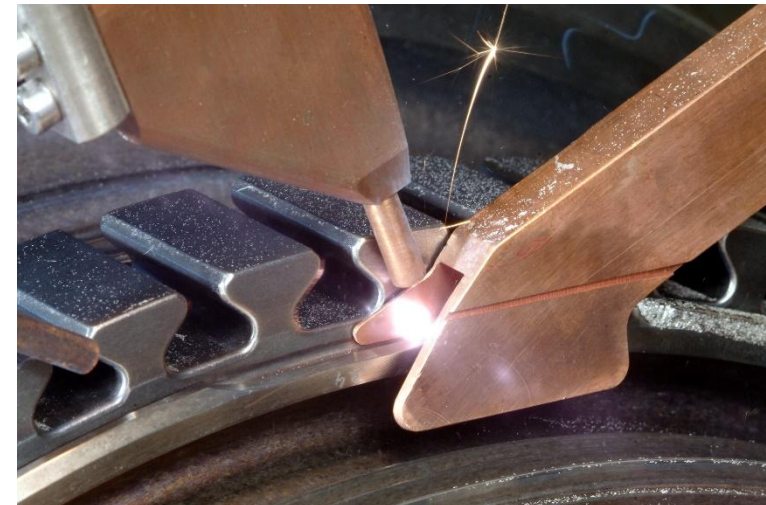
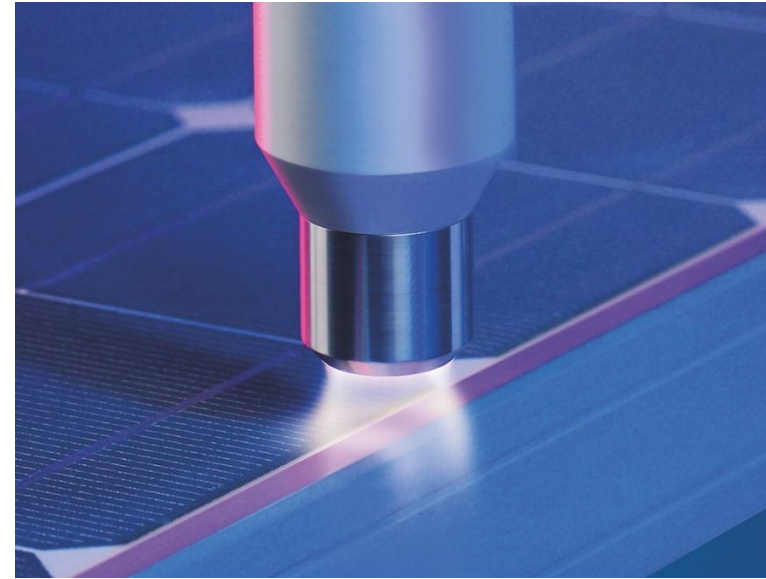
- **Finish:** Polishing is the common treatment, with mirror polishing employed in the high end. To increase the hardness level and extend the life span, some makers conduct nickel or chrome plating.

- **Material:** High-quality die steel is widely employed. A popular choice is the S136H, which can be sourced locally and features 30 to 35HRC, even reaching 55HRC after heat treating. Upscale products often use imported counterparts such as the P series from the US and the 2738 from Germany. Inputs for metal injection can be in aluminum or zinc alloy.



- **Hardness:** The mainstream range is 20 to 50HRC. Suppliers are raising this to 45 to 55HRC.

- **Service life:** The average life span is 300,000 to 500,000 shots. Makers are extending this by using imported die steel such as the P20H, 718H and 2738, which could support up to 700,000 shots. Chrome and nickel plating also prolongs the mold's service life.



Predmet: BRZA IZRADA PROTOTIPA I ALATA

3D PRINTING

REVOLUTIONISING

the

CLASSROOM

Biology students can study cross-sections of hearts or other organs.



Chemistry students can print out complex molecules to study.



Engineering students can print modified car or robot parts.



Geography students can print out topography, population or demographics of an area.

Using 3D Printers in the classroom could mean:



Graphic design students can create prototypes of product designs



Food Technology students can design molds and cookie cutter templates



Design and Engineering students can make prototypes of their creations.



Architectural students can print new or existing designs.



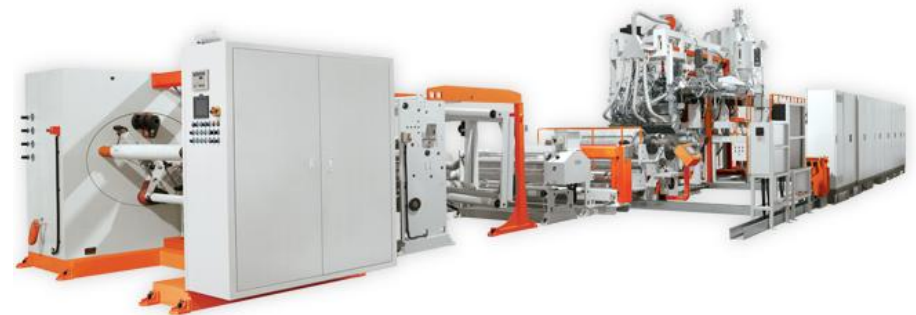
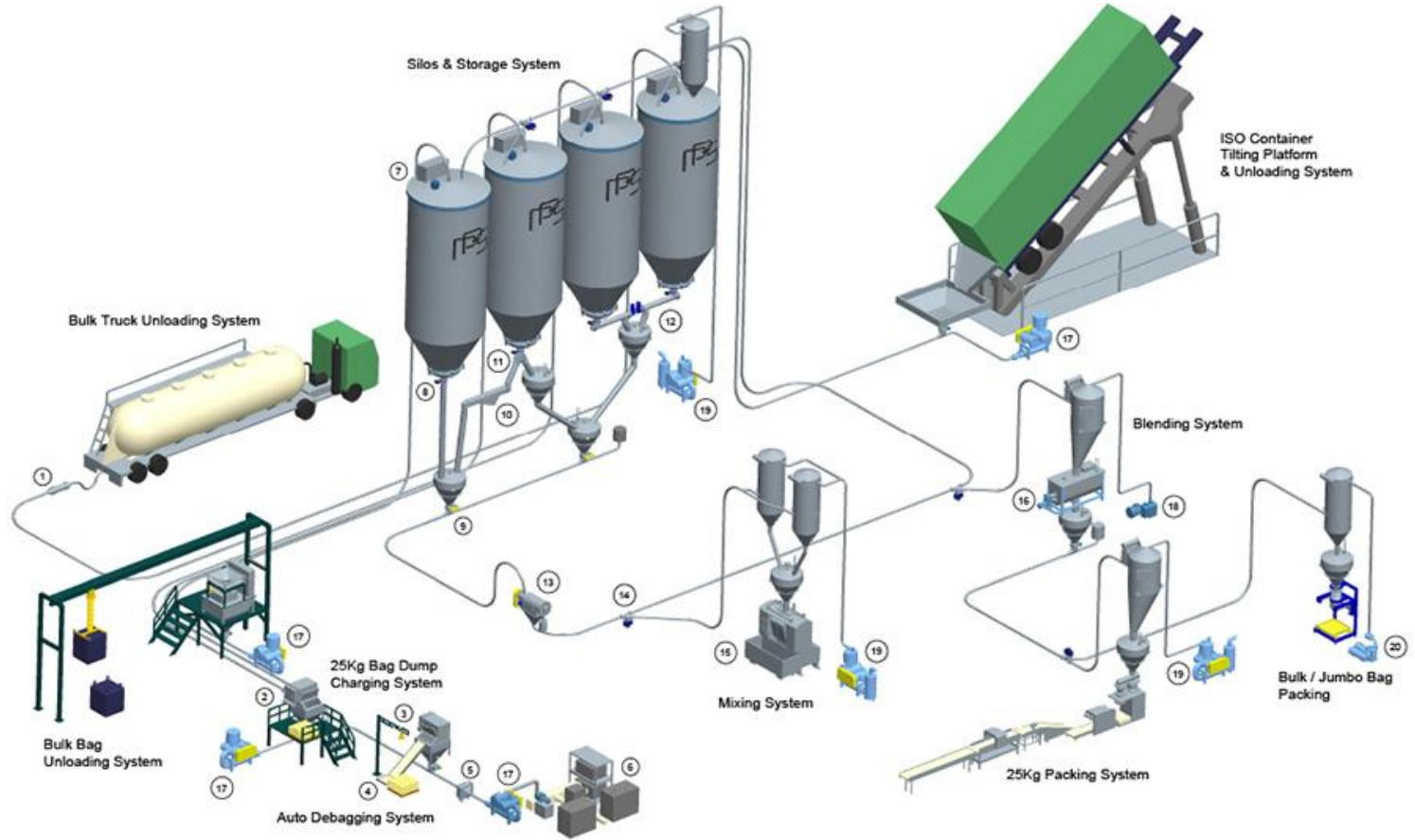
History classes can print artifacts for closer examination



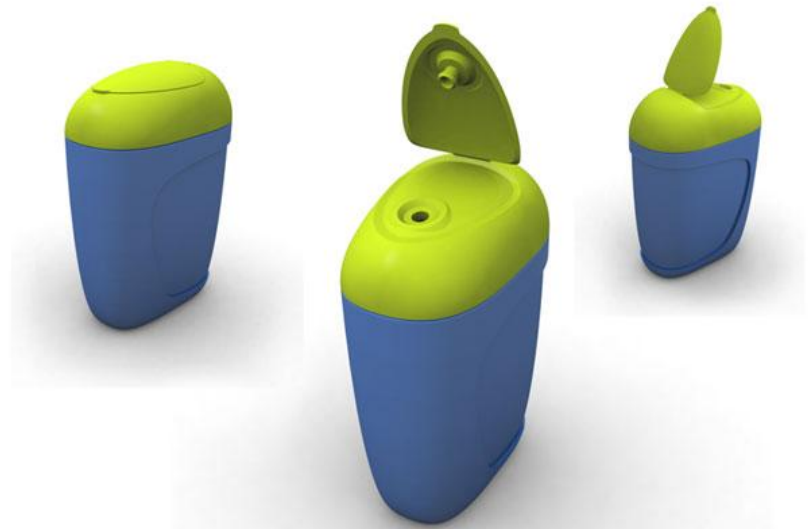
How does FDM compare with traditional processes for Lamborghini Lab?

Method	Cost	Lead Time
Traditional process	\$40,000	120 days
FDM Technology	\$3,090	20 days
Savings	\$36,910 (92%)	12 days (80%)

predmet: Savremeni obradni sistemi za preradu plastike



predmet: Dizajn i funkcionalnost proizvoda



predmet: Plastika i zaštita životne sredine

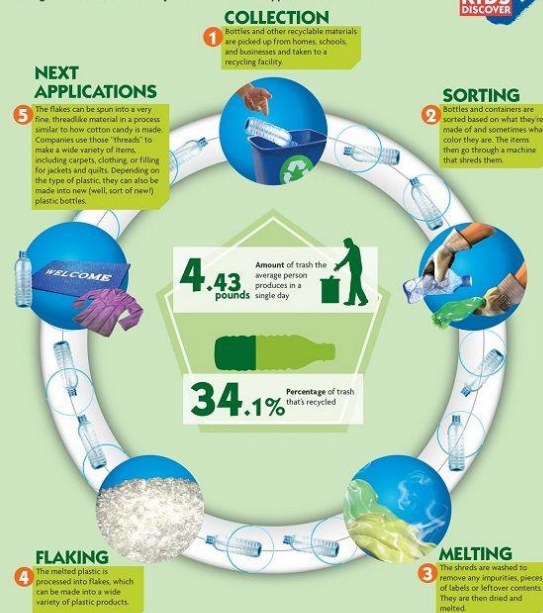
PLASTIC RECYCLING CHART

RECYCLED LOCALITY SYMBOL	1	2	3	4	5	6	7	RECYCLED LOCALITY SYMBOL	
NAME	PETE	HDPE	PVC	LDPE	PP	PS	OTHER	NAME	
DESCRIPTION	PET plastic is the most common for single-use bottled beverages, because it is inexpensive, lightweight and easy to recycle. It poses low risk of leaching. Breakdown products. Recycling rates remain relatively low (around 20%), though the material is in high demand by manufacturers.	HDPE is a versatile plastic with many uses, especially for packaging. It carries low risk of leaching and is readily recyclable into many goods.	PVC is tough and weather-resistant. It is commonly used for piping, siding and window applications. PVC contains chlorine, so the manufacture can release highly dangerous dioxin. If you must work with PVC, don't eat the plastic, wash your hands, and wear a mask. Also, never burn PVC, because it releases toxins.	LDPE is a flexible plastic with many applications. Historically, it has not been accepted through most American curbside recycling programs, but more and more communities are starting to accept it.	Polypropylene has a high melting point, and so is often chosen for containers that must accept hot liquid. It is gradually becoming more accepted by recyclers.	Polyethylene can be made into rigid or foam products — in the latter case it is popularly known as the bubble wrap. Standards Canada suggests polystyrene can be recycled through curbside recycling programs, but more and more communities are starting to accept it.	A wide variety of plastic meals that don't fit into the previous categories are lumped into number 7. A few are made from glass, polycarbonate and are compostable. Polycarbonate is number 7, and it has been found that it can leach potentially harmful chemicals.		DESCRIPTION
FOUND IN PRODUCTS	Soft drink, water and beer bottles, mouthwash bottles, peanut butter containers, salad dressing and vegetable oil containers, reusable food trays.	Milk jugs, wine bottles, bleach, detergent and household cleaner bottles, shampoo bottles, some trash and shopping bags, motor oil bottles, butter and yogurt tubs, cereal box liners.	Window sheetrock and detergent bottles, shampoo bottles, cooking oil bottles, clear food packaging, vacuuming, medical equipment, siding, windows, piping.	Squeezable bottles, bread, frozen food, dry cleaning and shopping bags, tote bags, clothing, furniture, carpet.	Some yogurt containers, soup bottles, sandwich bottles, caps, straws, medicine bottles.	Disposable plates and cups, meat trays, egg cartons, carry-out containers, aspirin bottles, compact disc cases.	Three and five-gallon water bottles, bullet-proof materials, sunglasses, CDs, iPod and computer cases, signs and displays, certain food containers, Tylenol.		RECYCLED INTO PRODUCTS
RECYCLED INTO PRODUCTS	Plastic bottles, film, tote bags, furniture, carpet, sneakers, shoes, (compostable) meat containers.	Laundry detergent bottles, oil bottles, pipes, recycled containers, floor tiles, storage bins, barrels, barrels, doghouses, plastic tables, housing.	Decking, painting, mulch, roofing gutters, flooring, cables, speed bumpers, mats.	Trash can liners and cans, compost bins, recycling containers, pens, pencils, ballpoint pens, fiber pens.	Signal lights, battery covers, brooms, brushes, auto battery cases, fire extinguishers, motorcycle fenders, bicycle seats, car seats, public trash.	Insulation, light switches, plates, egg cartons, vents, toys, foam packing, carry-out containers.	Plastic lumber, custom-made products.		

© 2005 by Star Clark Images • Originally Printed on the Daily Green at <http://www.dailygreen.com> • First Printed Design by Brian Driggs at <http://www.brian-driggs.com> • All Rights Reserved

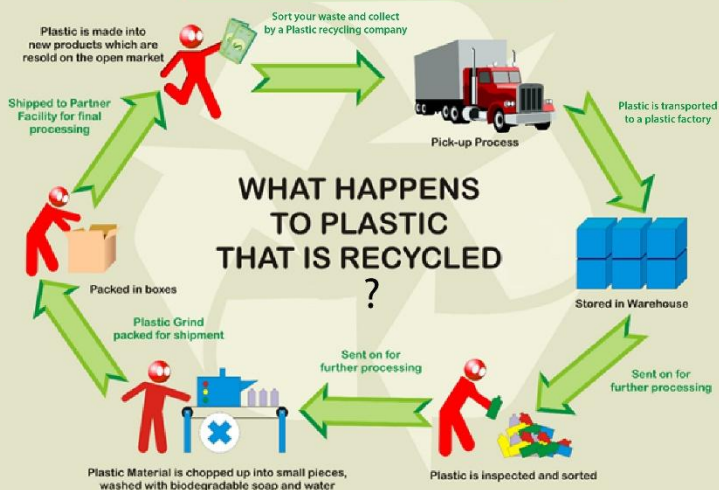
HOW A BOTTLE IS RECYCLED

GOOD JOB! You tossed that plastic bottle into the recycling bin rather than straight into the trash. But do you know what will happen to that bottle now?

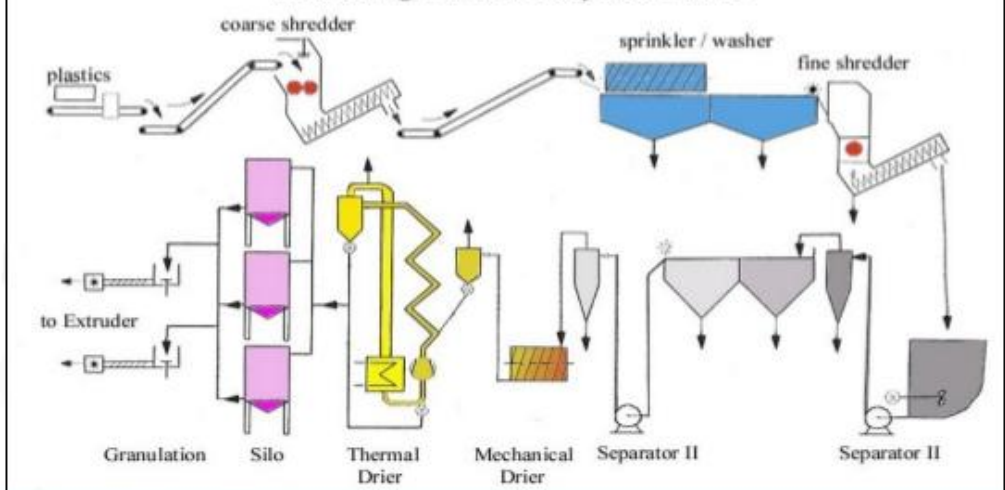


SOURCES • <http://www.epa.gov> • <http://earth911.com/>

PLASTICS RECYCLING OVERVIEW



Processing Plant of Recycled Plastic





Zašto ovaj modul?



- ogroman asortiman proizvoda na bazi polimera (plastika, guma, itd.)
- uzlazni trend proizvodnje i prerade polimera u svetu
- značajna proizvodnja delova od plastike u našoj zemlji
- kontinuirana zamena metalnih delova komponentama od plastike
- svakodnevni razvoj novih materijala na bazi polimera (kompoziti, nano-materijali, biopolimeri itd.)
- tehnologije prerade polimernih materijala veoma su zastupljene u malim i srednjim preduzećima
- mogućnost naučno-istraživačkog, poseta fabrikama, stručna praksa i radno angažovanje tokom studija...
- **NA TRŽIŠTU RADA POSTOJI NEDOSTATAK INŽENJERA OVOGA PROFILA, A POTRAŽNJA ZA NJIMA JE PERMANENTNA!!!!!!!**

На ФТН-у најсавременија Лабораторија за полимере



GDE SE ZAPOSLLITI?!

- Hipol - Odžaci
- Aling Conel – Gajdobra
- Hemofarm – Vršac
- Minakva – Novi Sad
- Inmold – Požega
- Peštan – Arandjelovac
- Apatinska pivara – Apatin
- Norma group -Subotica
- Grundfos – Indija
- Hemovent - Beograd
- Sintelon, Tarket – Bačka palanka
- Texo - Indija
- Neofyton – Novi Sad.....