

## 7. CRACKS

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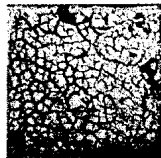
Starch can not be dissolved in water at room temperature. Its polymeric molecules are packed into granules, which collapse in water at 50-70 degrees. Some molecules of water join polymeric chains of starch by hydrogen connections. Molecules of starch break up to shorter glucose chains at temperatures close to 200 degrees. We do not assume obtained glucose solution to be starch solution.

Elastic properties of polymeric materials strongly differ from elastic properties of metals. Big zone of convertible nonlinear deformations and critical relative lengthening about 10 is characteristic for them. Polymeric molecules are characterized by entropy elasticity. The most probable distance between the ends of a chain is equal to 0. In a starch solution forces of interaction of polymeric chains are rather weak. Critical relative lengthening is about 1. In a solution with high concentration of starch so called glassing process occurs and the solution becomes non-extensible. Critical tension decreases with growth of time of load. There exists a minimal time in which a non-liquid piece of starch solution can be collapsed. Also a minimal constant loading which can force such body to collapse exists.

Only solutions with concentrations lower then 10% are liquid and can be poured. Maximal possible concentration of starch is about 50%.

Evaporation from surface layers happens after placing starch solution on a surface. Oozing of some water from lower layers is also possible. Concentration of starch in surface layers increases. This causes fast growth of forces of interaction of polymeric molecules in surface layers. Surface layers tend to decrease their volume. Lower layers and surface on which starch solution is placed hold them. Tension appears in surface layers as a result. This tension is not big. First visible cracks form after several hours. For a solution with initial concentration higher then 30% concentration changes very slowly. In this case no tensions able to form a crack appear.

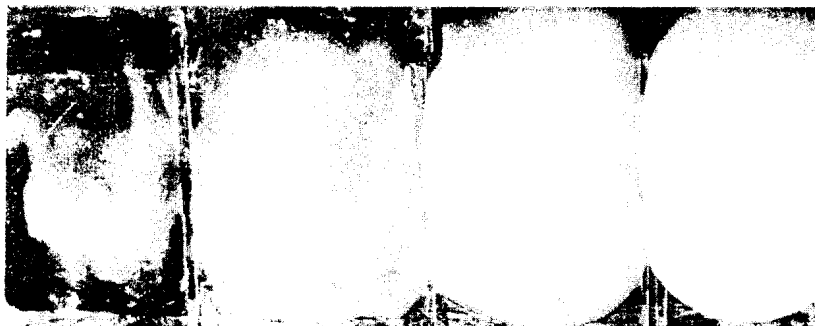
First cracks often appear in places where starch is not well dissolved or external bodies are immersed. First cracks appear on the perimeter of a starch layer if starch interacts weakly with the material from which the vessel is made. They appear in the center of the surface of a starch layer if interaction of starch with vessel is strong. In both cases first cracks appear earlier then if no interaction with vessel exists. In all cases we have a very complex mechanical system and it is hard to make a good model of it.



Time of appearance of the first visible crack varies from 1 hour up to several days. The concentration by which cracks usually appear at fastest is about 15 percents. Distance between cracks increases with growth of concentration. Such shape and size of cracks and distance between cracks exist which is most favorable energetically. That is why are cracks identical in a uniform system. Second crack is usually perpendicular to first one because line of biggest tension is perpendicular to first crack.



Starch interacts strongly with surface of this vessel



Artificial cut preserves the surface from the further crack formation in the direction of the cut

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