SNS COLLEGE OF TECHNOLOGY

An Autonomous Institution
Coimbatore – 35

Accredited by NBA – AICTE and Accredited by NACC – UGC with 'A+ Grade
Approved by AICTE , New Delhi and Affiliated to Anna University , Chennai.

DEPARTMENT OF AGRICULTURE ENGINEERING

19AGT303 – DAIRY AND FOOD ENGINEERING

III – YEAR VI SEMESTER

UNIT 1 – PROPERTIES OF FOODS AND METHODS OF FOOD CONCENTRATION

TOPIC 3 – Textural Properties of Food

TEXTURAL PROPERTIES OF FOOD

Texture is the composite of attributes which arise from the structural elements of foods and the manner in which it registers with the physiological senses.

(Philip Sherman, 1970)

Food Texture

- **Texture is a sensory property,** thus, only a human being (or an animal in the case of animal food) can perceive and describe it.
- **Multi-parameter attribute**, not just tenderness or chewiness, but a gamut of characteristics;
- **Derived from the structure of the food** (molecular, microscopic or macroscopic);
- **Detected by several senses**, the most important ones being the **senses of touch and pressure.**
- The texture testing instruments can detect and quantify only certain physical parameters which then must be interpreted in terms of sensory perception;

Importance of Food Texture

1. **Critical:**

   food in which texture is the dominant quality characteristic (meat, celery, chips)

2. **Important:**

   foods in which texture is significant but not dominant (fruit, bread, candy)

3. **Minor:**

   foods in which texture makes a negligible contribution (beverages, thin soups)

Textural Properties

- Hardness
- Springiness
- Brittleness
- Chewiness
- Gumminess
- Firmness
- Tenderness
- Adhesiveness
- Lumpiness
- Oiliness
- Juiciness
- Crispiness

Primary properties

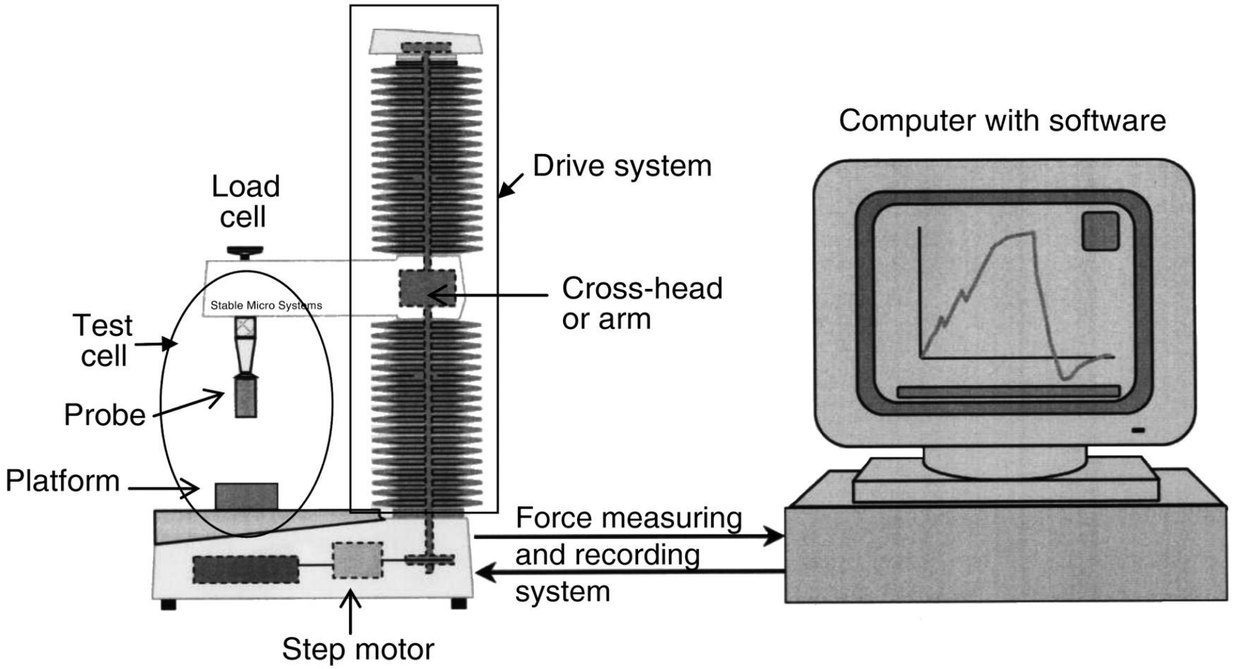
Mechanical property	Physical definition	Sensory
Hardness	Force necessary to attain a given deformation	Force required to compress a substance between molar teeth (in the case of solids) or between tongue and palate (in the case of semi-solids).
Cohesiveness	Extent to which a material can be deformed before it ruptures.	Degree to which a substance is compressed between the teeth before it breaks.
Viscosity	Rate of flow per unit force.	Force required to draw a liquid from a spoon over the tongue.
Springiness	Rate at which a deformed material goes back to its un-deformed condition after the deforming force is removed	Degree to which a product returns to its original shape once it has been co pressed between the teeth.
Adhesiveness	Work necessary to overcome the attractive forces between the surface of the food and the surface of the other materials with which the food comes in contact.	Force required to remove the material that adheres to the mouth (generally the palate) during the normal eating process.

Secondary properties

Mechanical property	Physical definition	Sensory
Fracturability	Force with which a material fractures: a product of high degree of hardness and low degree of cohesiveness.	Force with which a sample crumbles, cracks, or shatters.
Chewiness	Energy required to masticate a solid food to a state ready for swallowing: a product of hardness, cohesiveness and springiness	Length of time (in sec) required to masticate the sample, at a constant rate of force application, to reduce it to a consistency suitable for swallowing.
Gumminess	Energy required to disintegrate a semi-solid food to a state ready for swallowing: a product of a low degree of hardness and a high degree of cohesiveness.	Denseness that persists throughout mastication; energy required to disintegrate a semi-solid food to a state ready for swallowing.

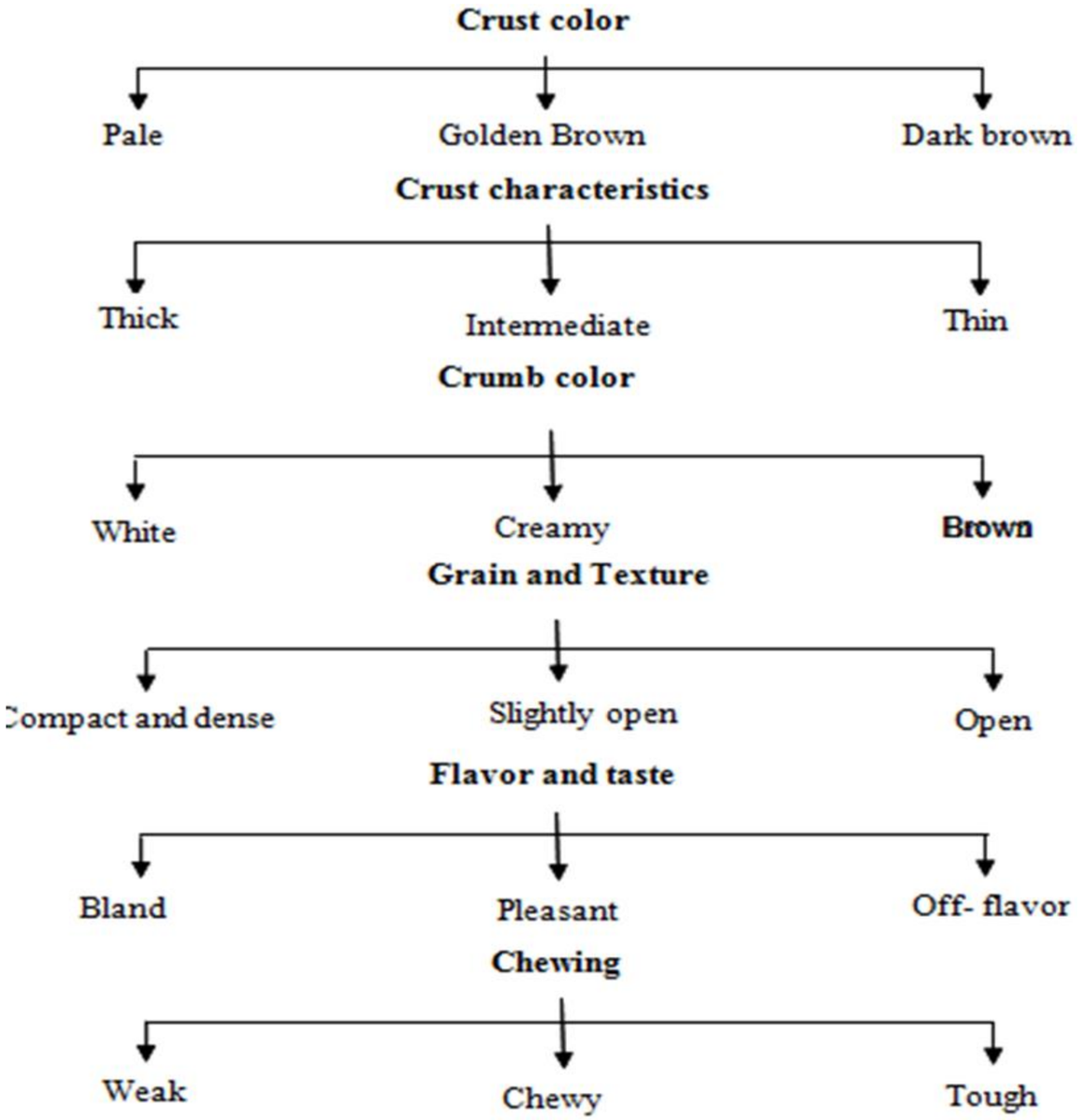
Methods of texture evaluation

- **Subjective** or **sensory evaluation**
  - Sensory impressions of test panels to assess the textural quality
- **Objective** or **instrumental measurements**
  - Parameters measured from physical instruments are evaluated that indicates quality



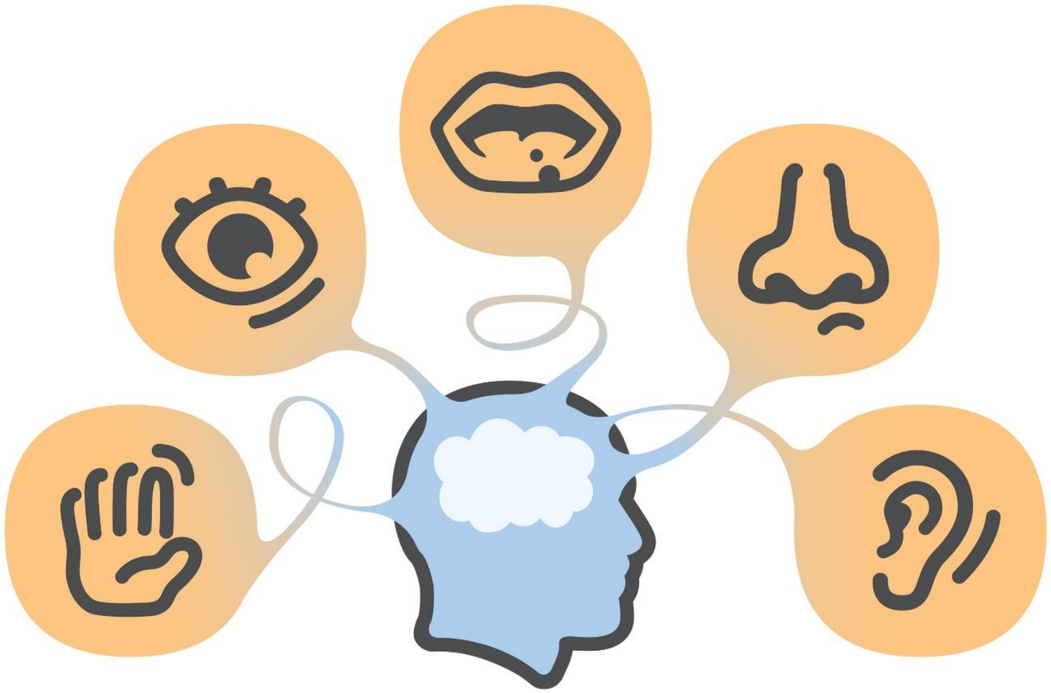
Introduction to Sensory evaluation

- Evaluated directly with **sensory methods** or correlated with human senses.
- Since food industry relies upon **consumers judgement for texture preference.**
- Sensory parameters - Characteristics significant with **acceptability** of finished products



Sensory Evaluation

- Judging the **quality of food** by a panel of judges.
- The evaluation deals with measuring, analyzing and interpreting the qualities of food as they are **perceived by the senses** of sight, taste, smell, touch and hearing.



Question	Method
Are products different?	Discrimination Tests
If products are different, how are they different?	Descriptive Analysis
What is the acceptability of a product? Is one product preferred over another?	Affective/Hedonic Tests

Requirements for conducting sensory tests

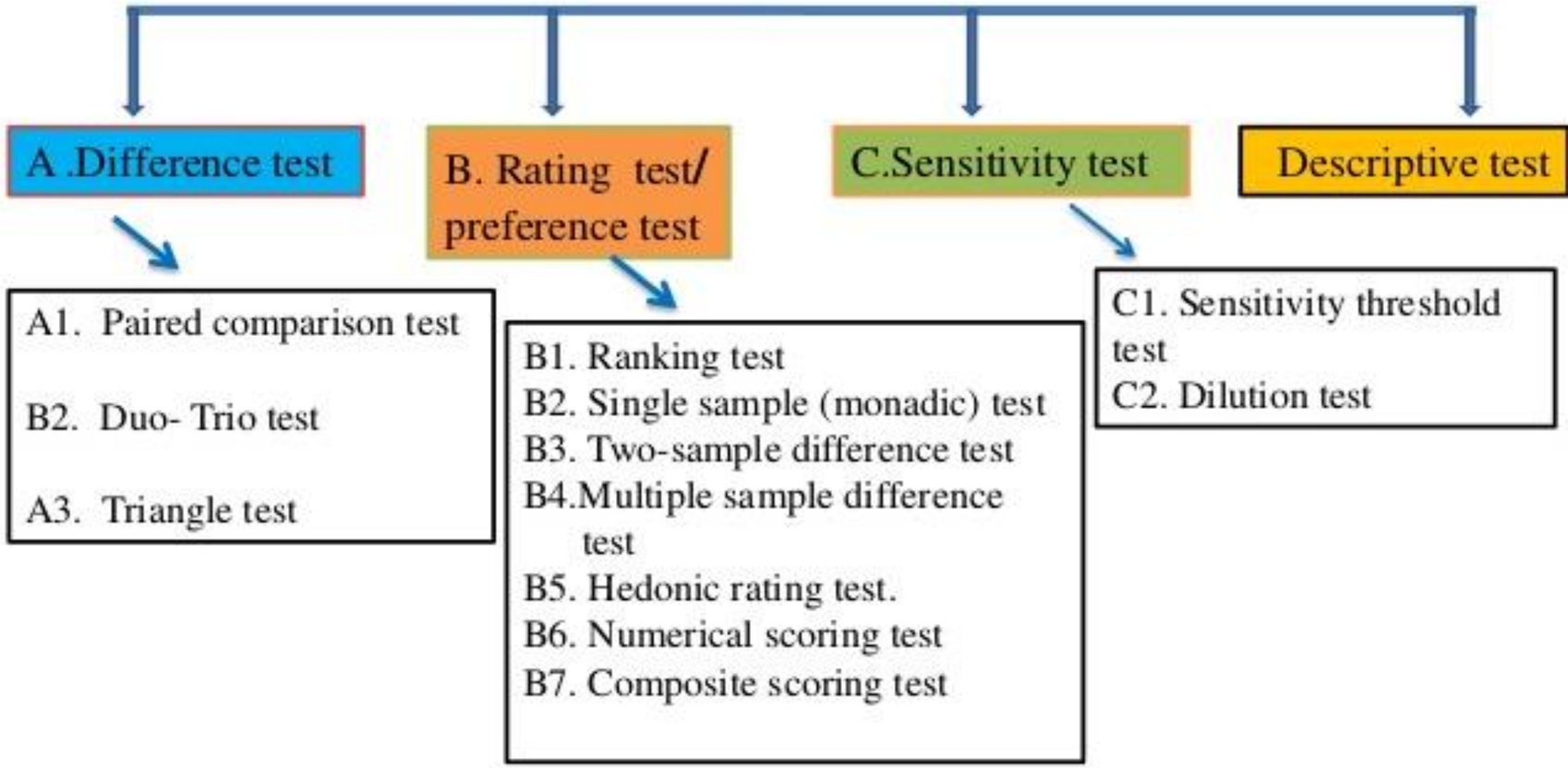
- Trained panel members
- Testing laboratory
- Sample preparation and presentation
- Techniques of smelling and tasting
- Testing time and avoidance of fatigue
- Design of the experiment and analysis of the results.

Behaviour	Eye	Nose	Tongue	Finger	Ear
Color	X				
Surface	X		X	X	
Shape	X			X	
Taste		X	X		
Odor		X			
Aroma		X			
Elasticity			X	X	
Hardness			X	X	
Roughness			X	X	
Crispness			X	X	X

Types of tests

1. **Difference** tests (Discrimination)
2. **Rating** tests (Quantitative differences)
3. **Sensitivity** tests
4. **Descriptive** tests

The selection of a particular test method will depend on the defined objective of the tests, accuracy desired and personnel available for conducting evaluation



Texture Profile Analysis

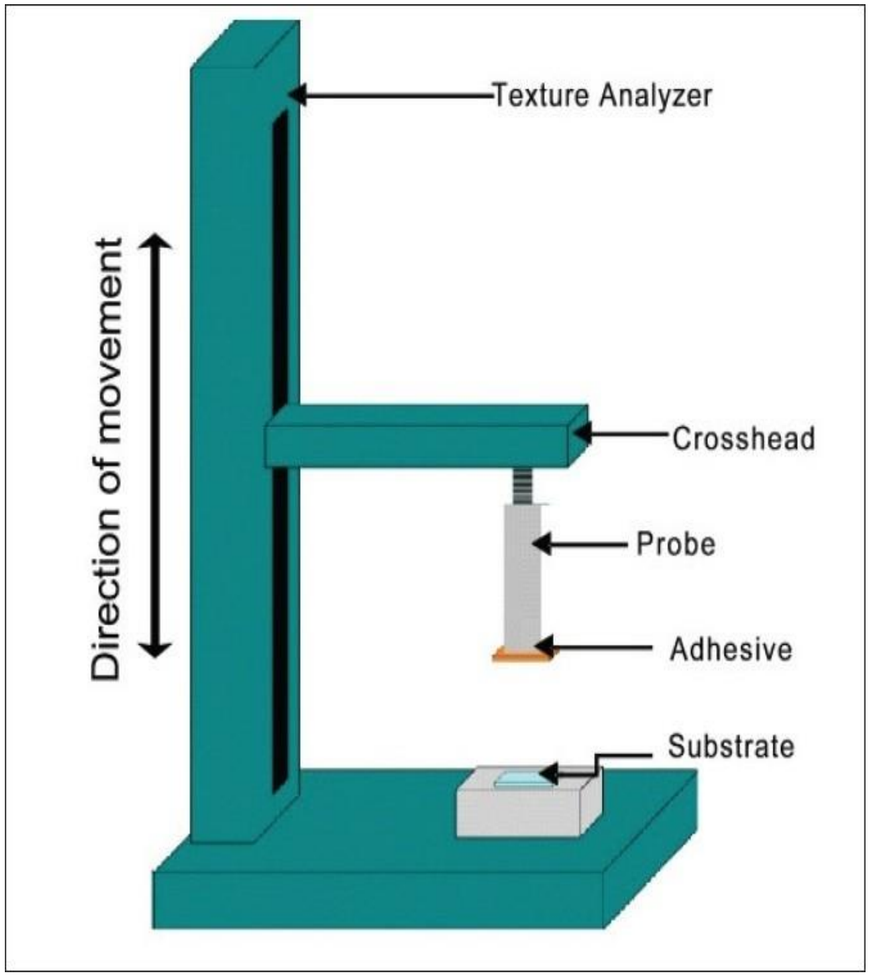
- Double compression test
- Often called as two bite test since it mimics mastication action**.**

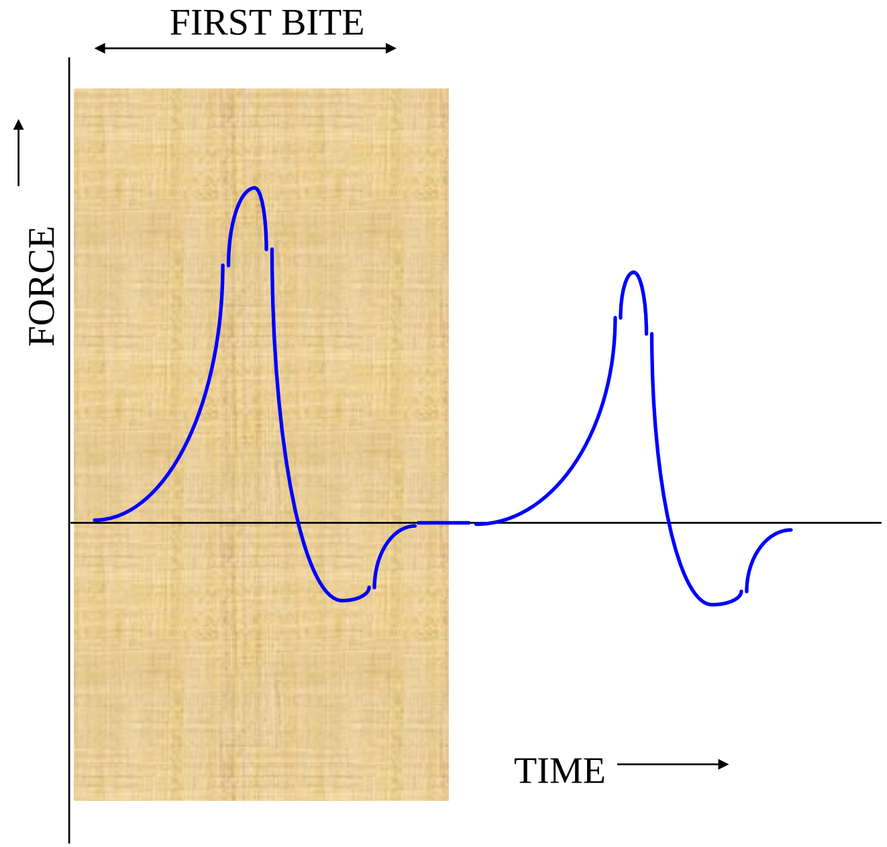
Considerations:

1. Use of appropriate **probe** (larger dia flat probes for compression tests)
2. **Speed** of compression and withdrawal
3. Selecting appropriate TPA **parameter**

Texture profile analysis

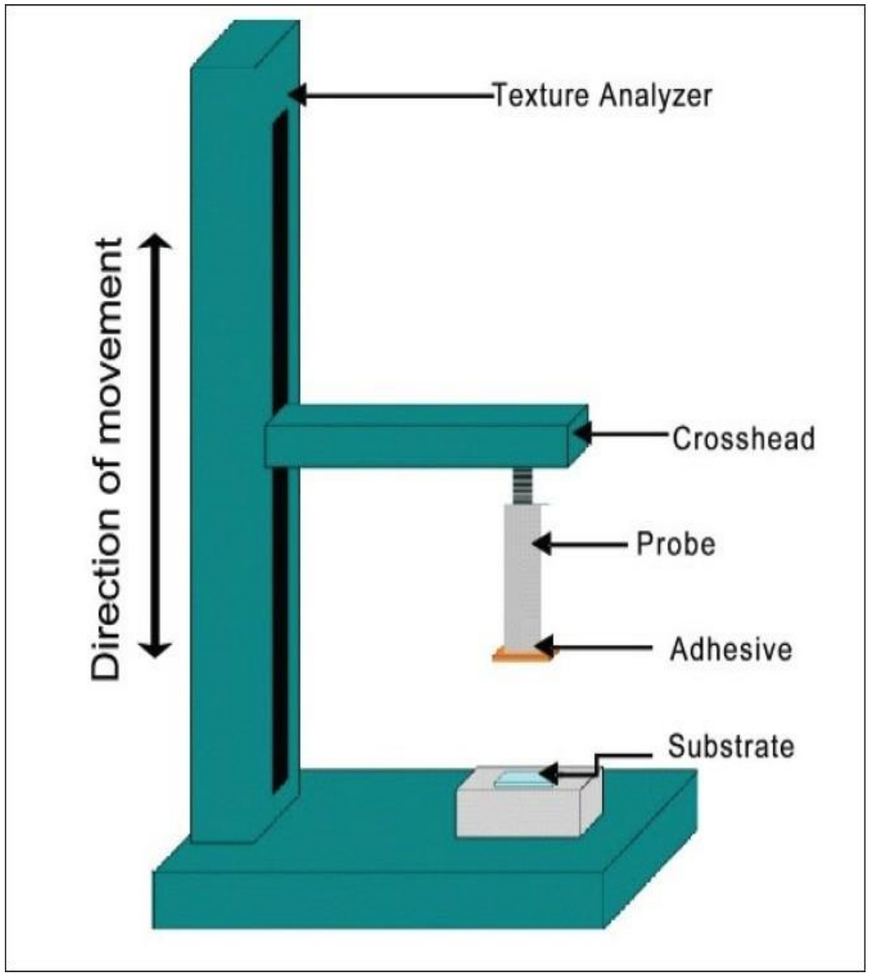
- a plot of force as a function of time- a ***texture profile.***

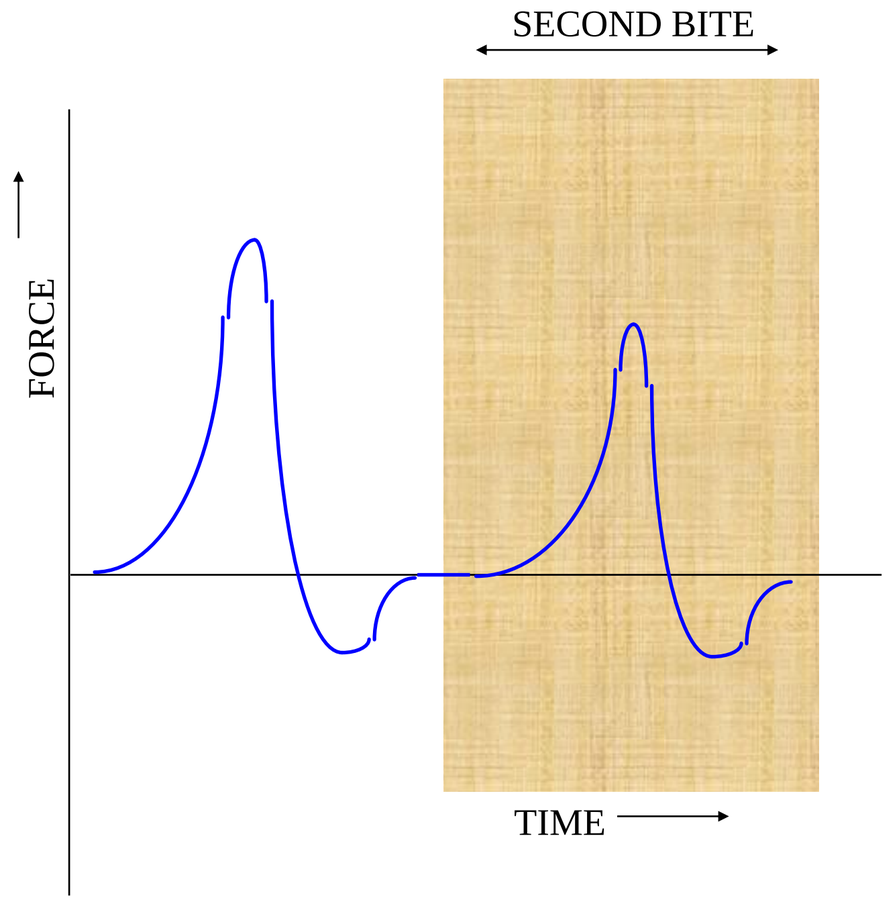




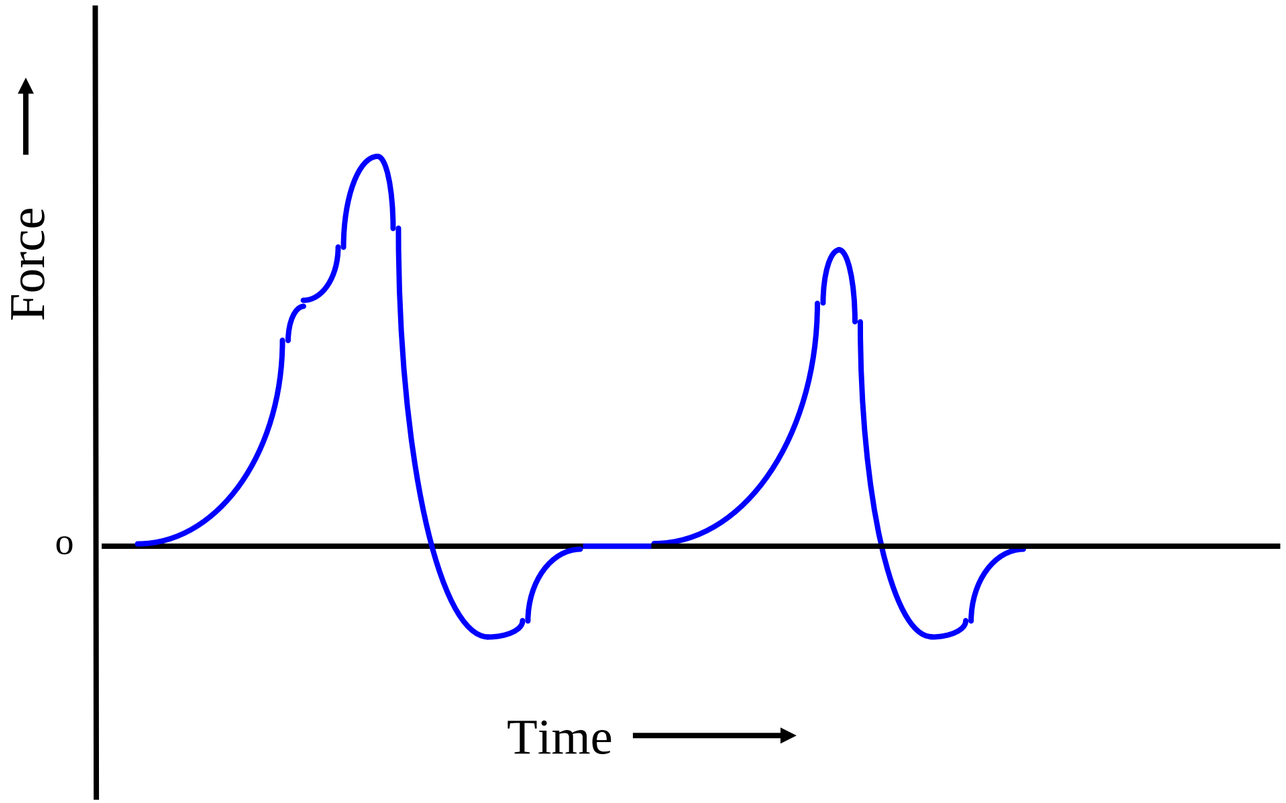
Texture profile analysis

- a plot of force as a function of time- a ***texture profile.***

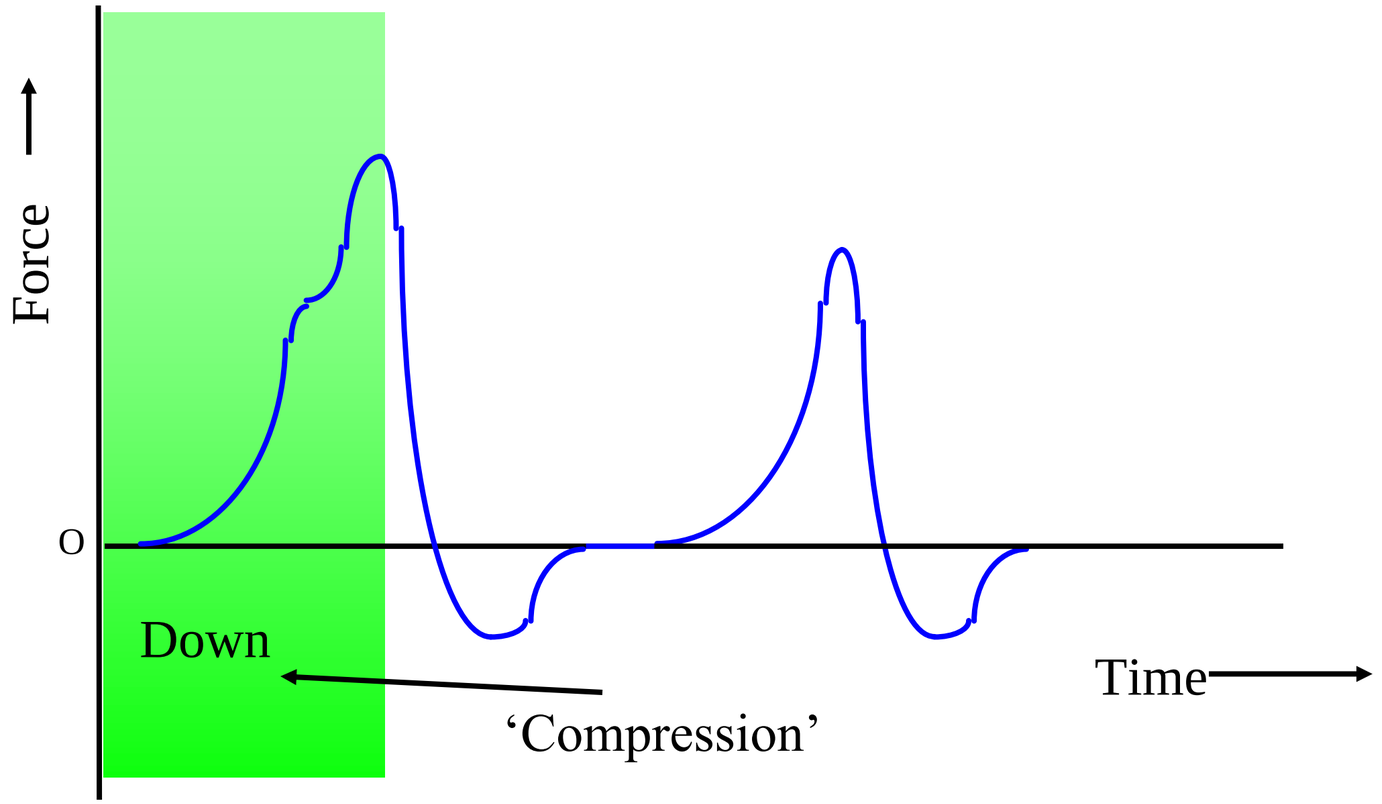




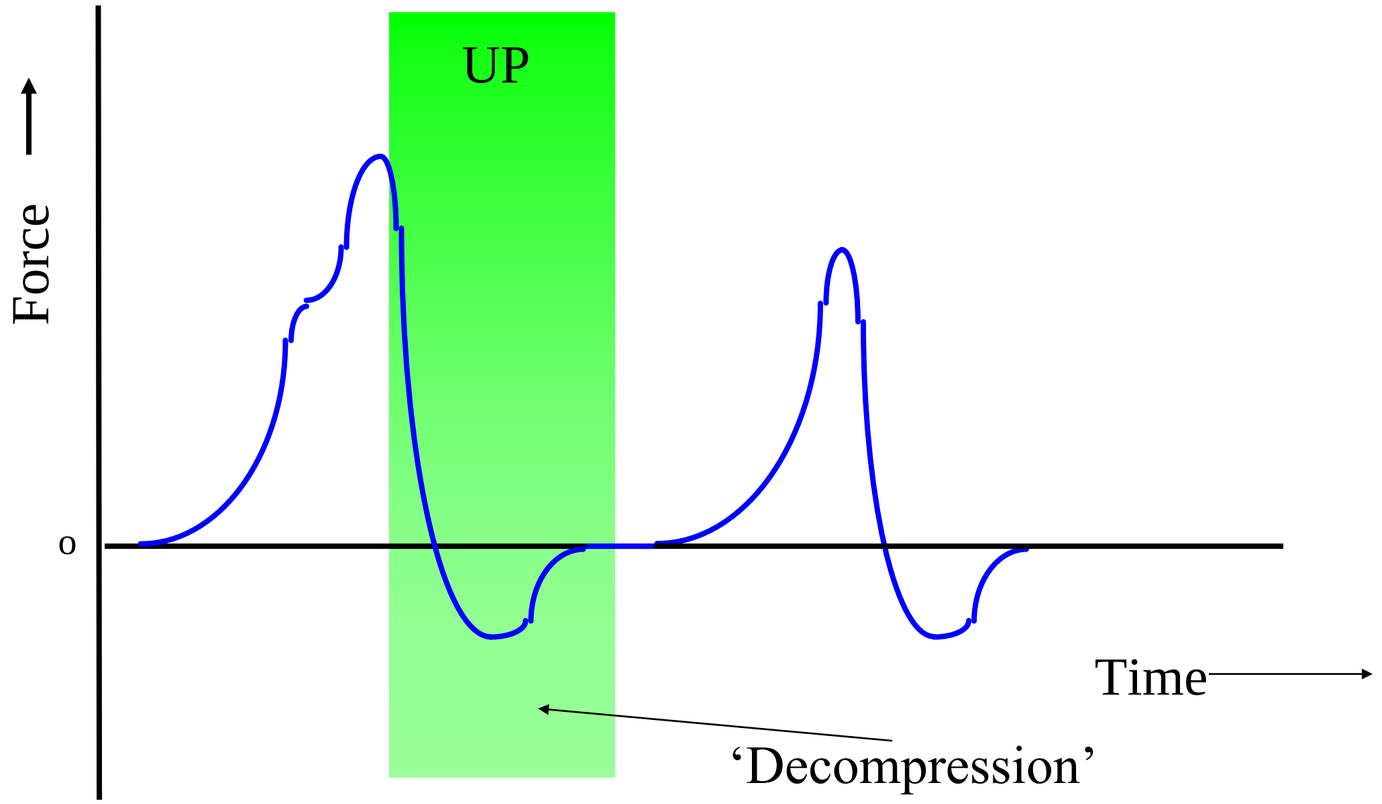
TPA– changes in force during Movement of the Probe



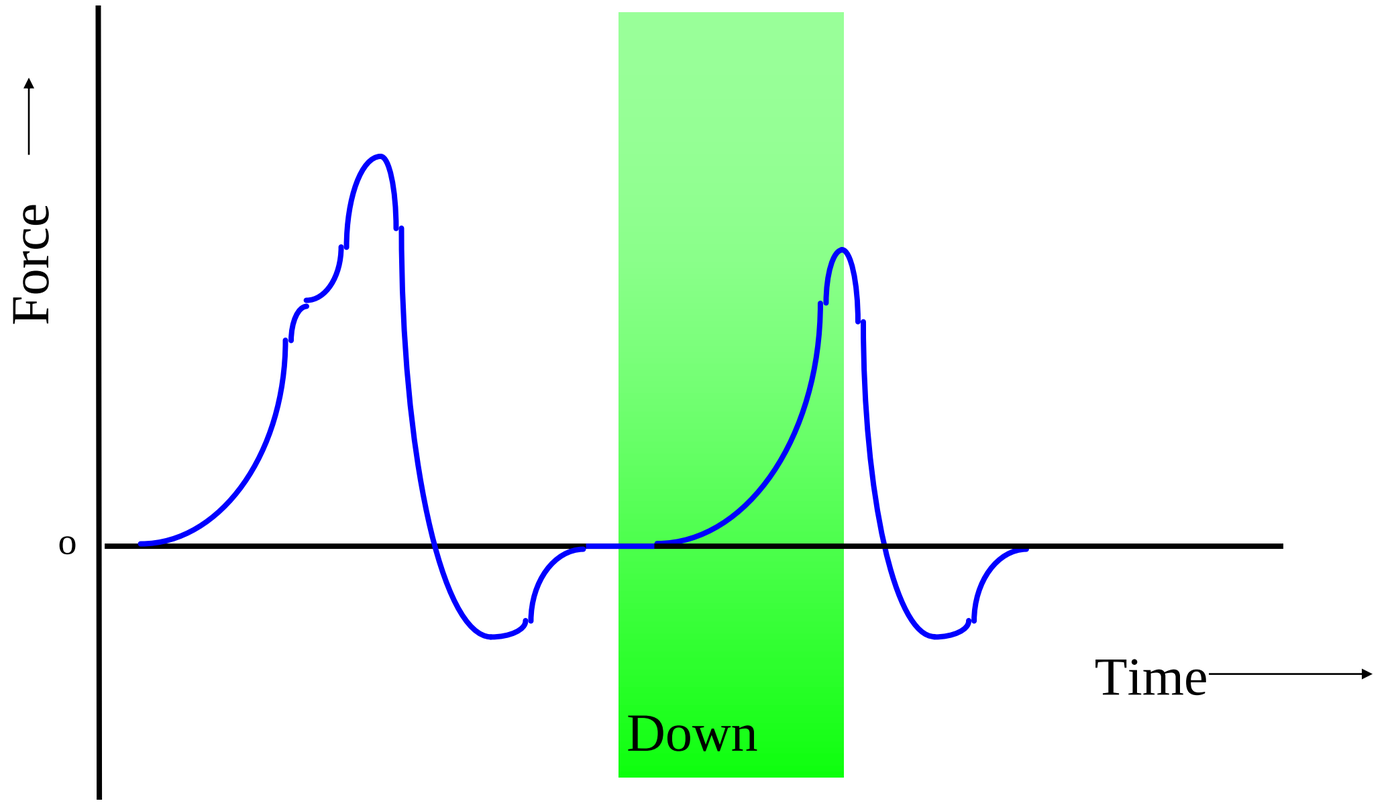
TPA– changes in force during Movement of the Probe



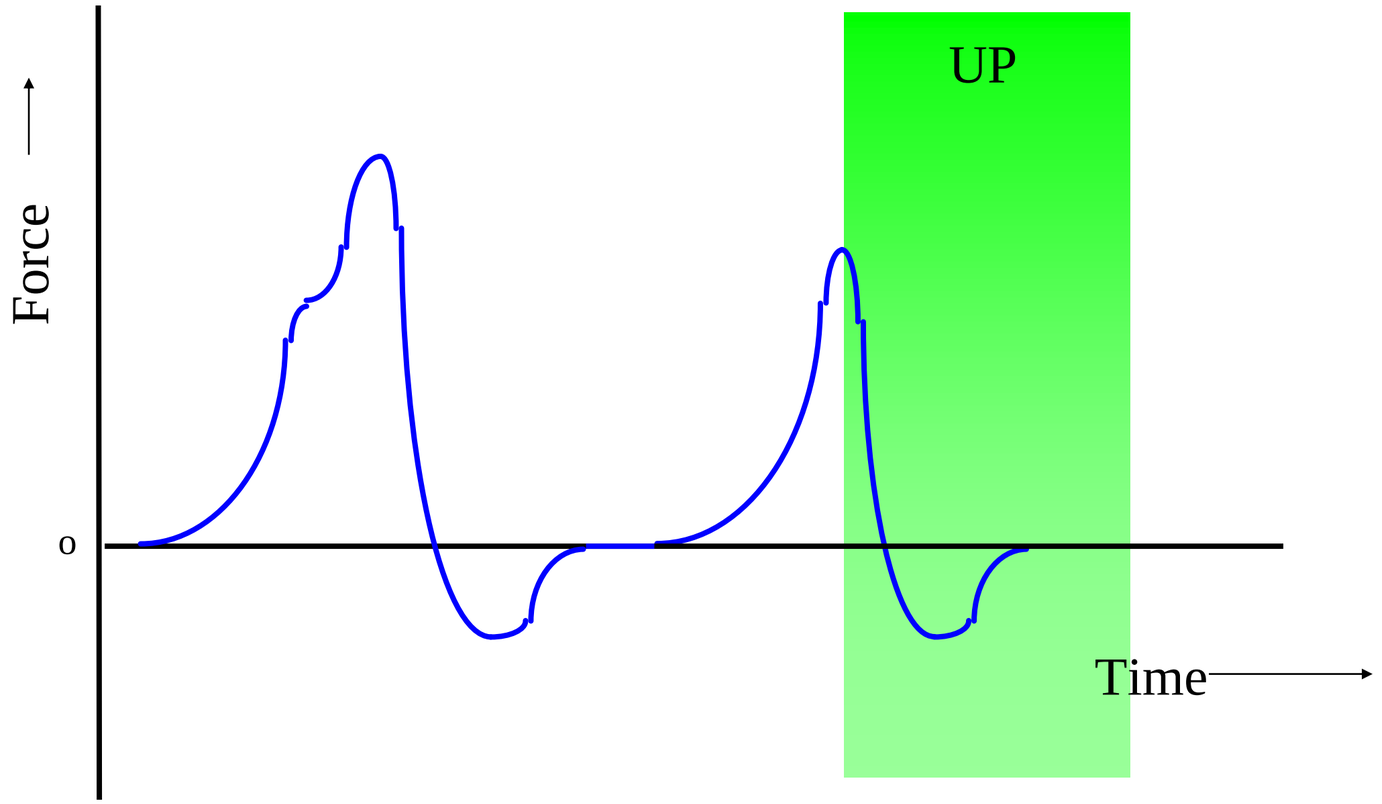
TPA– changes in force during Movement of the Probe



TPA– changes in force during Movement of the Probe

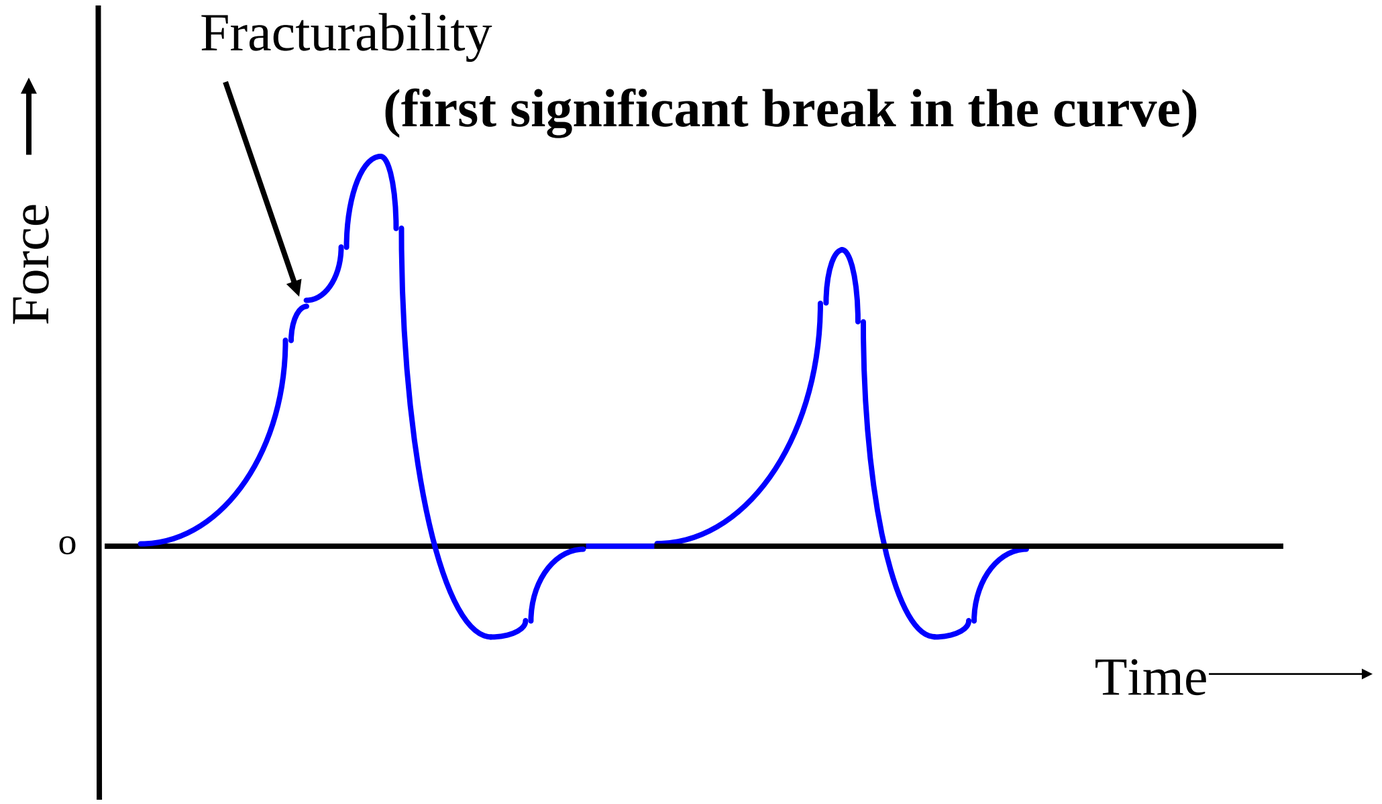


TPA– changes in force during Movement of the Probe



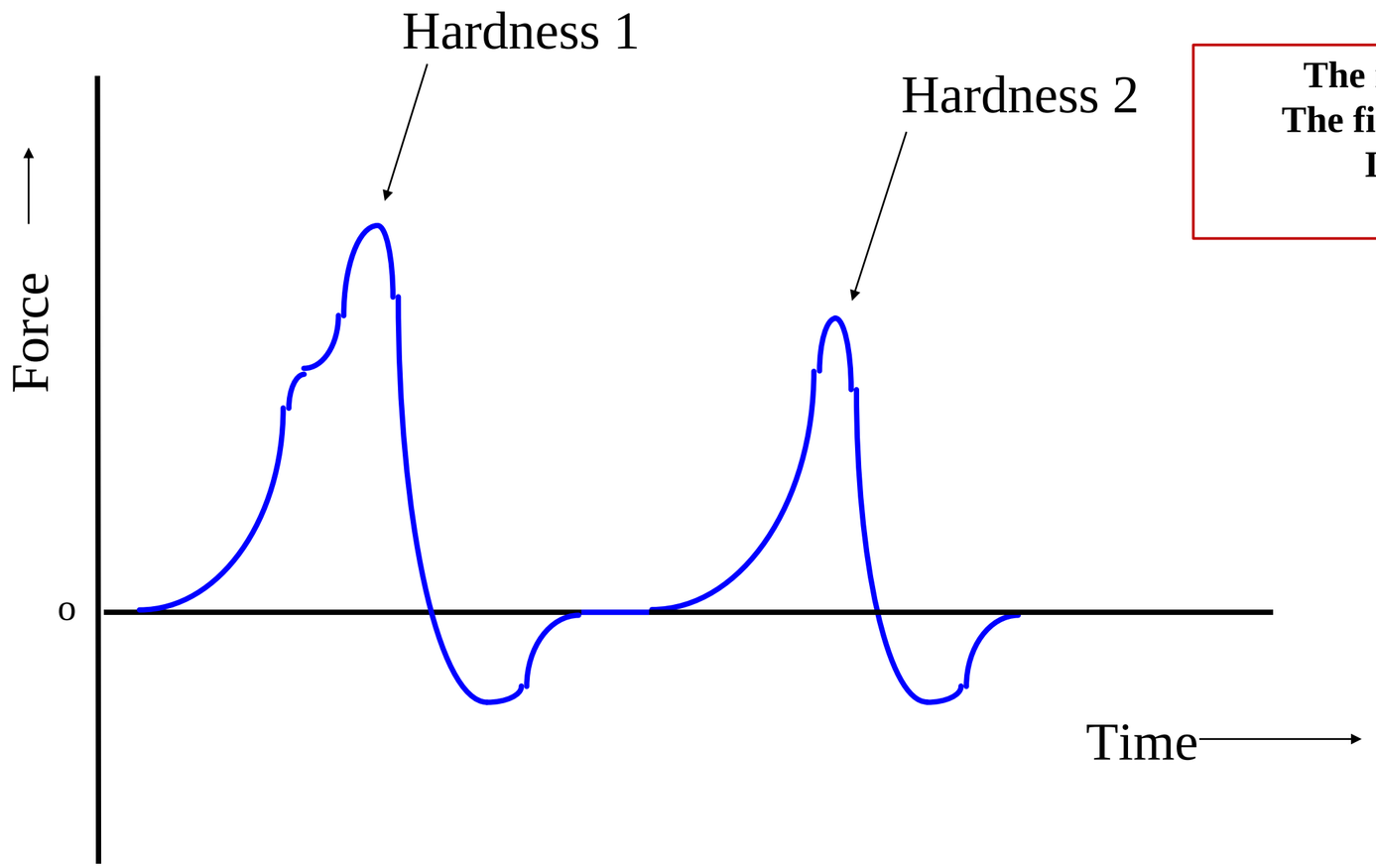
TPA– Texture parameters in the graph

Fracturability



TPA– Texture parameters in the graph

Hardness

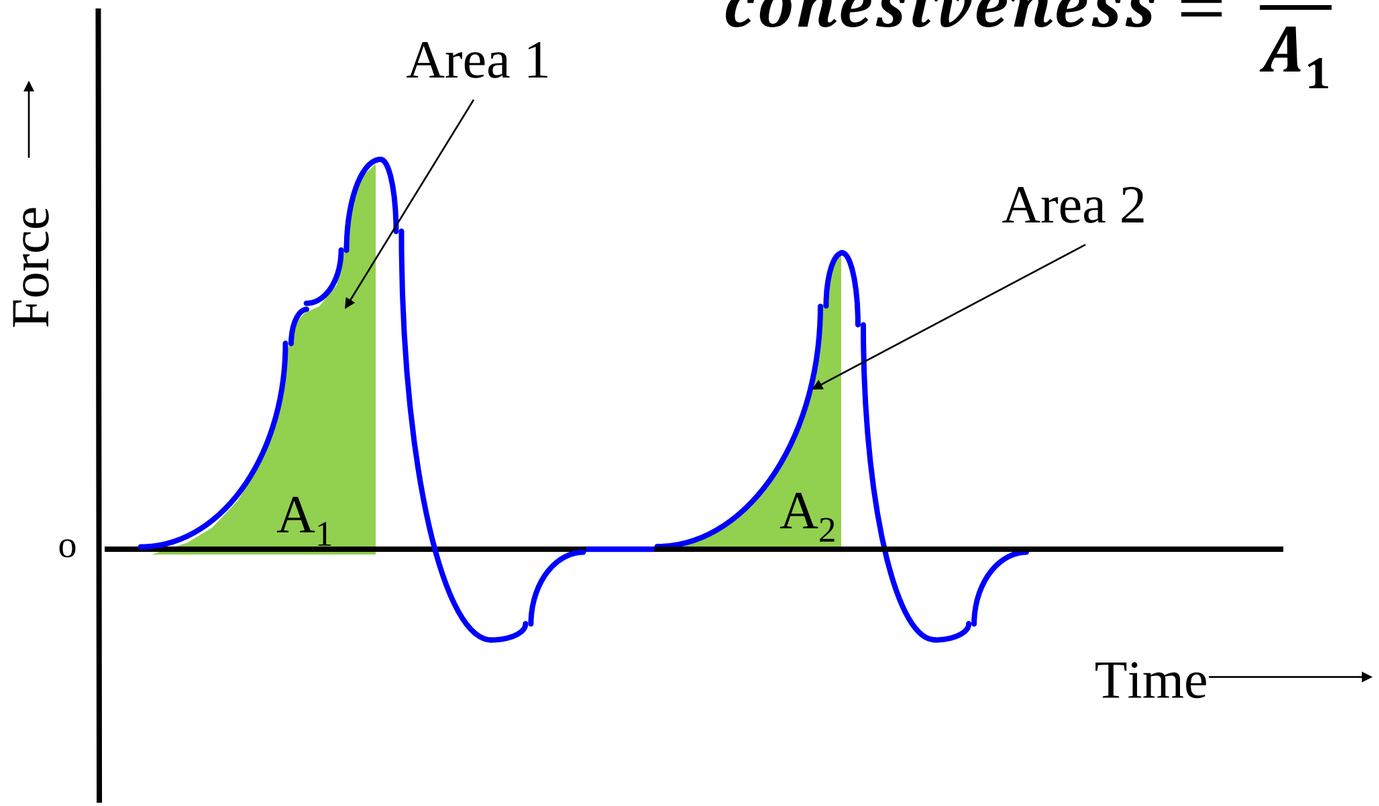


The maximum force during The first cycle of compression. Is also known as the "firmness".

TPA– Texture parameters in the graph

Cohesiveness and gumminess

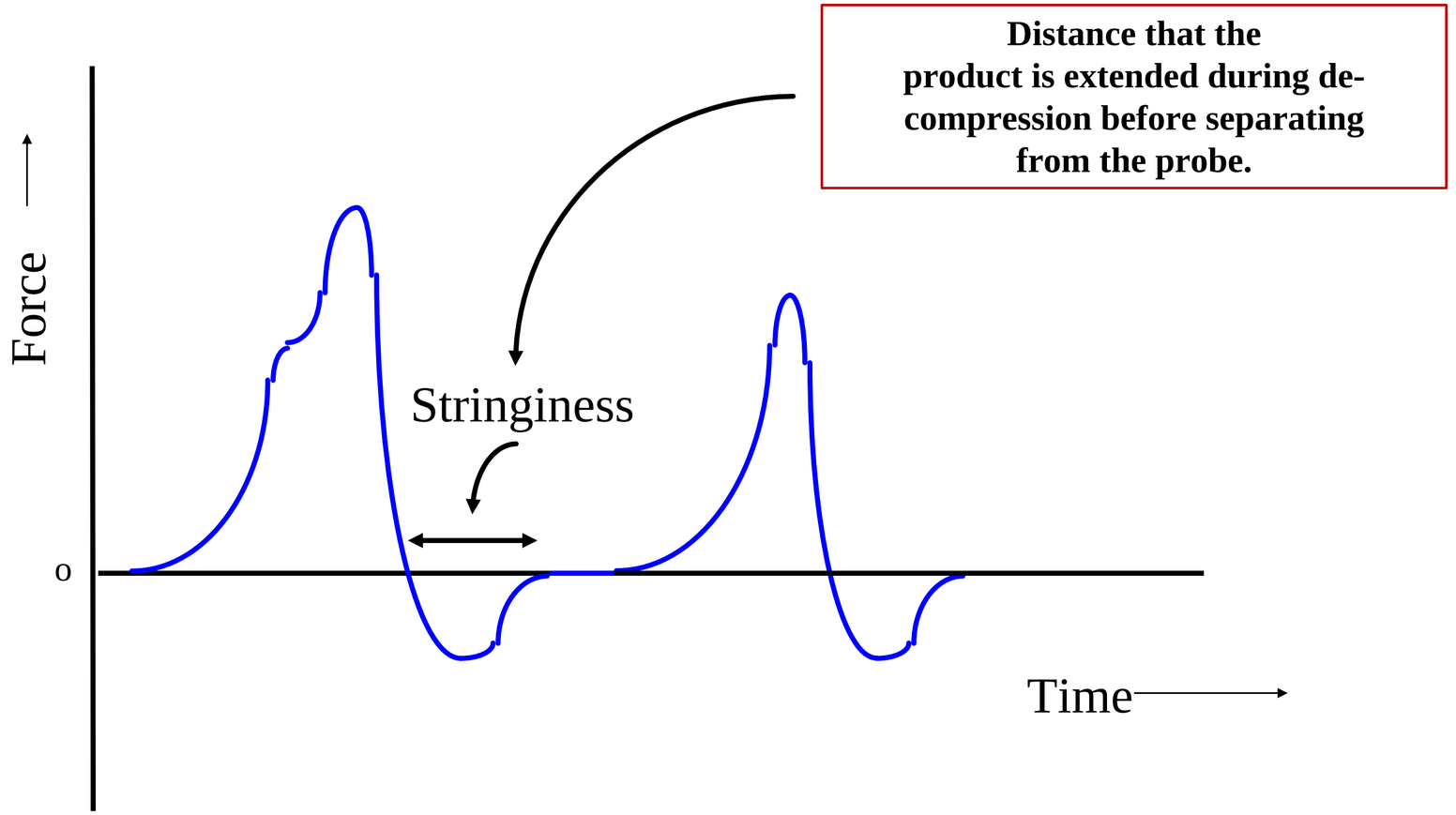
$$cohesiveness = \frac{A_2}{A_1}$$



$$gumminess = hardness * cohesiveness$$

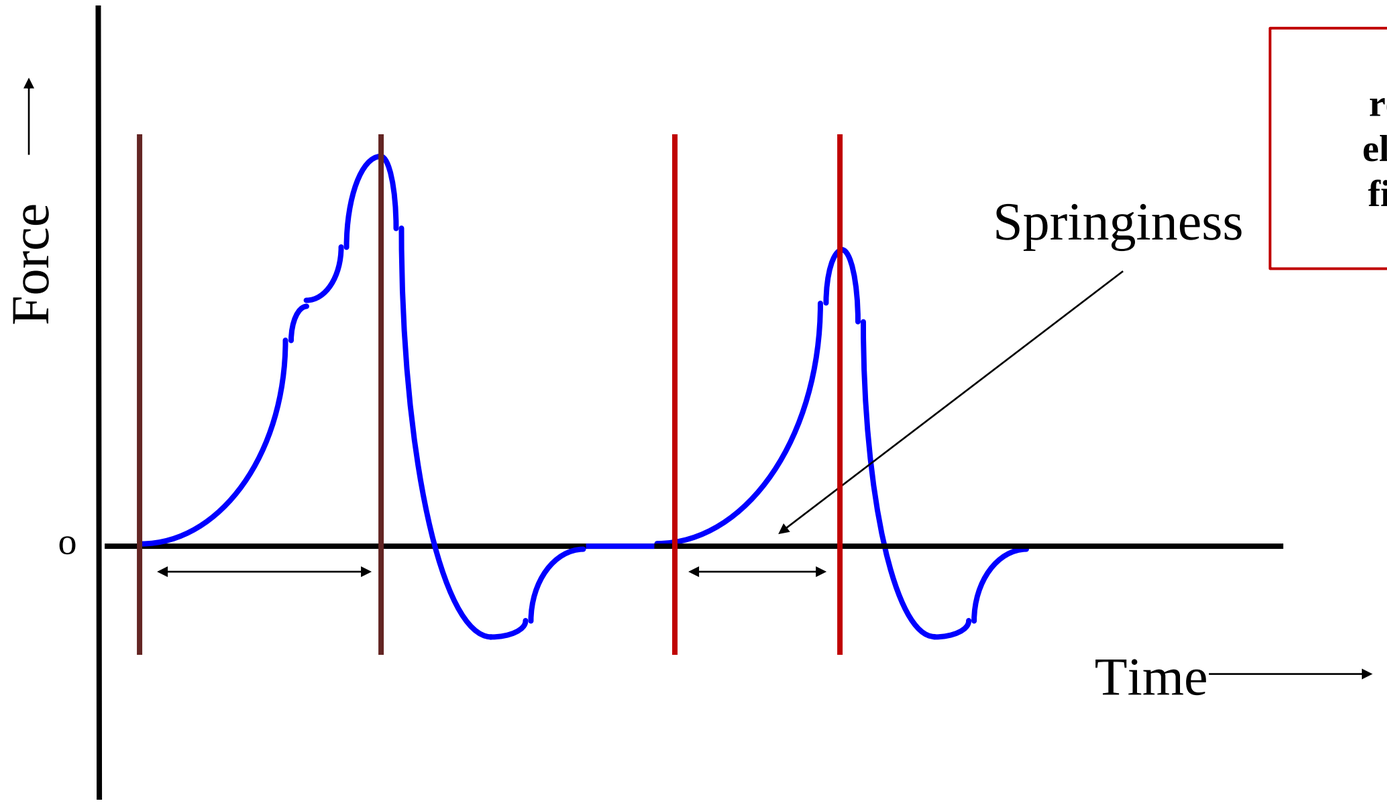
TPA– Texture parameters in the graph

Springiness



TPA– Texture parameters in the graph

Chewiness

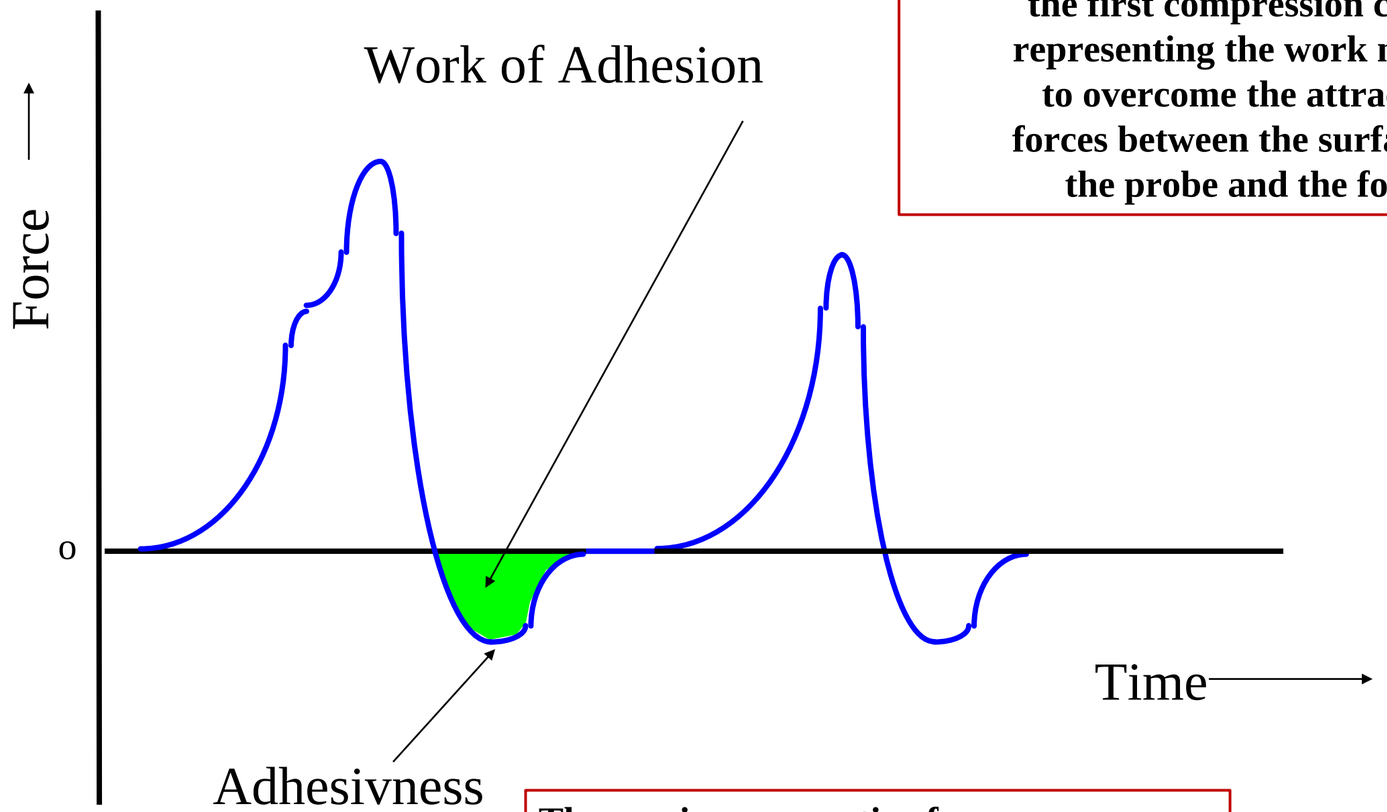


Height that the food recovers during the time that elapses between the end of the first cycle and the start of the second cycle.

$$chewiness = gumminess * springiness$$

TPA– Texture parameters in the graph

Adhesiveness



negative area for the first compression cycle - representing the work needed to overcome the attractive forces between the surfaces of the probe and the food.

The maximum negative force of the first compression cycle

Texture profile- graph