FOOD TEXTURE ANALYSIS...
食物物性测试分析

WHAT IS FOOD TEXTURE…

什么是食物的质构

All the mechanical, geometrical and surface attributes of a product perceptible by means of mechanical, tactile and, where appropriate, visual and auditory receptors.

产品所有的机械性的、几何性的和表面的特性，可通过机器、感触和适当的看、闻等手段测量
(ISO 5492, VOCABULARY FOR SENSORY EVALUATION)

“All encompassing” complex-specific multidimensional attribute

复杂而特殊的多维特性

TEXTURE ANALYSIS物性分析...

"An empirical measure, which can be correlated with fundamental aspects of structure and macromolecular behaviour".

它是一个经验式测量方法，与结构的基本外形和高分子行为有关

FUNDAMENTAL
本质特性

IMITATIVE
模拟

EMPIRICAL
经验测试

OPTIMUM
优化

TEXTURE ANALYSIS: There are a number of typical parameters associated with this science与这门科学相关的性能参数

- Hardness硬度
- Springness破裂性
- Adhesiveness粘附性
- Cohesiveness内聚性

Related to "real-life" characteristics of a product! 都与产品的实际寿命有关系的特性

CNS FARNELL

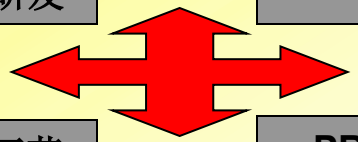
TEXTURE TESTING APPLICATIONS... 应用

- Scale-up Approval 产品等级认证
- Specification Development 使用说明
- Shelf-life Trials 产品保存时间试验
- Ingredient Changes and product matching
  成分改变和产品匹配

PRODUCT DEVELOPMENT 产品研发

- CRITICAL QUALITY POINTS 质量点
- Integral part of ISO 9002
  ISO质量认证的主要部分
- Raw material and Supplier conformance
  原材料和供应商的一致性

QA & QC SYSTEMS 质量检测和控制



PROCESS DEVELOPMENT 流程工艺

- At-Line Process Control 生产流程控制
- Proactive rather than Reactive Processing 帮助生产前做好准备
- Process Optimisation 生产优化
- Pipeline and Pump Design 对管道和输送系统的设计有参考价值

PRODUCT EVALUATION 产品评价

- Product Improvements 产品改进
- Sensory Correlations 与口感有关
- Texture Profile Analysis 组织概况分析
- Consumer Studies 消费者研究
- Product Matching 产品匹配

(Adapted from Borwanka, 1992)

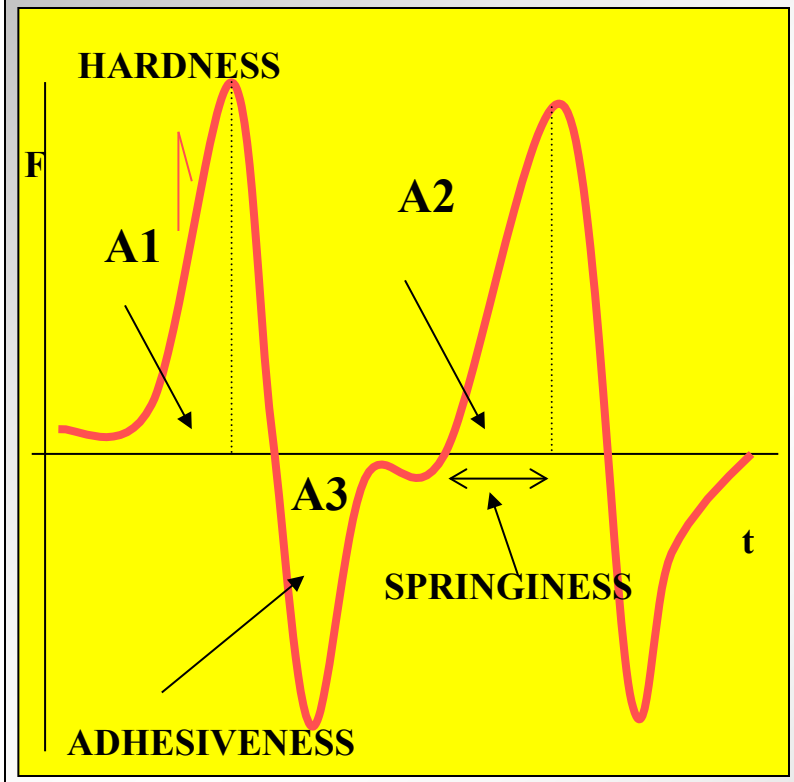
质构仪原理及部分参数定义

原理：样品在可控力的作用下，产生形变曲线，测定结果可以用力、变形和时间来确定。

参数	感官定义	仪器定义
硬度(Hardness)	牙齿间用来压迫样品所需要的力，定义为获得指定的形变所必须的力	第一个压缩循环的峰值力
弹性(Springness)	当破坏力去掉时，材料回复为其原来状态的速率	在第一次咬断末期和第二次咬断开始的时间内食物恢复的高度
粘附性(Adhesiveness)	用来克服食物表面与接触物表面之间的吸引力所做的功，接触物是指与食物相连的物体（如舌头，牙齿，上腭）	第一次咬断的负数区域的面积代表将压缩探头脱离样品所必须的功
内聚性（Cohesiveness）	组成产品结构的内部键力（值越大，内聚力越强）	第二次压缩与第一次压缩的正力之比（面积向下的冲击）

VARIABLE: TEST CONFIGURATION
可变参数：测试结构

TEXTURE PROFILE ANALYSIS



- Hardness 硬度 = Peak +ve force
- Springiness弹性= Height food recovers
- Cohesiveness粘结性 = A2/A1
- Adhesiveness 粘附度= Negative area from first bite
- Fracturability破裂度= First break in cycle
- Gumminess粘性 = Semi-solid foods calculated from Hardness x Cohesiveness
- Chewiness 咀嚼性= Solid foods calculated from Hardness x Cohesiveness x Springiness

Variables to Texture Analysis…
物性分析测量中可变的参数

Texture analysis procedures are generally empirical in nature. Variation in test parameters must be understood and eliminated in order to maximise the benefits and relevance of data generated.

Instrument Specific Variables:

- Test Speed 测试速度

- Test Direction 测试方向

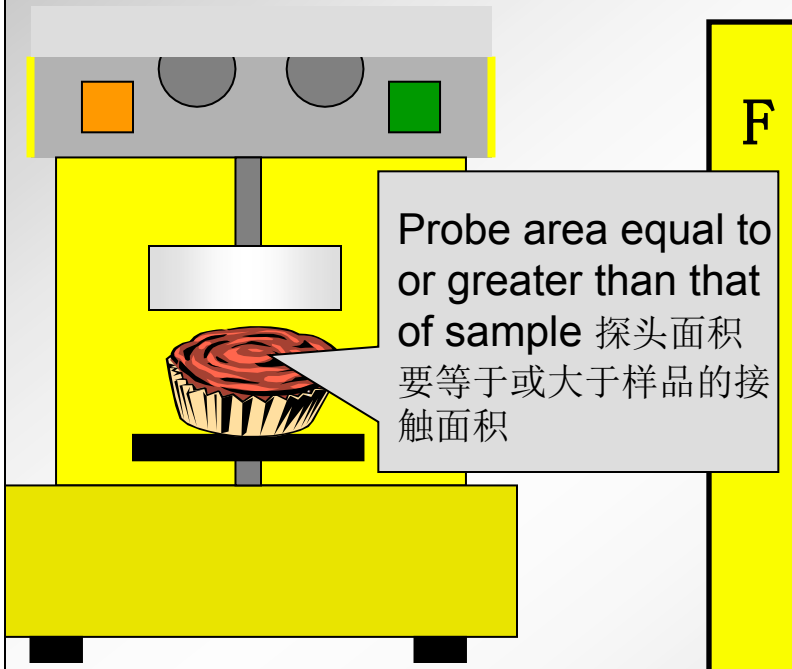
- Distance of Penetration 穿透距离

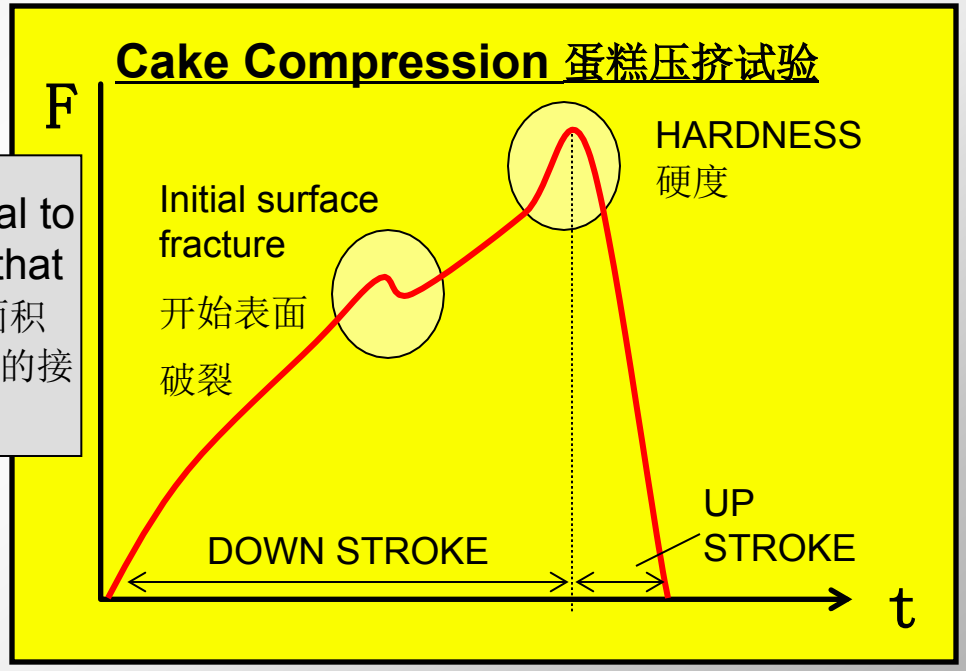
- Probe Type 探针型号

VARIABLE: PROBE TYPE 探头型号

DOWNWARD FORCES向下施力

COMPRESSION: Probe (cylindrical probe or flat plate) comes into contact with sample exerting force upon it.
压挤试验：探头（圆柱形或扁平盘状）尽力压向样品



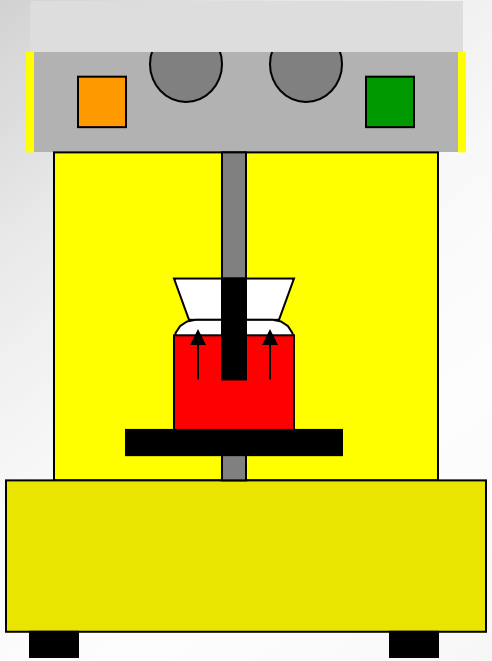


VARIABLE: PROBE TYPE 探头型号

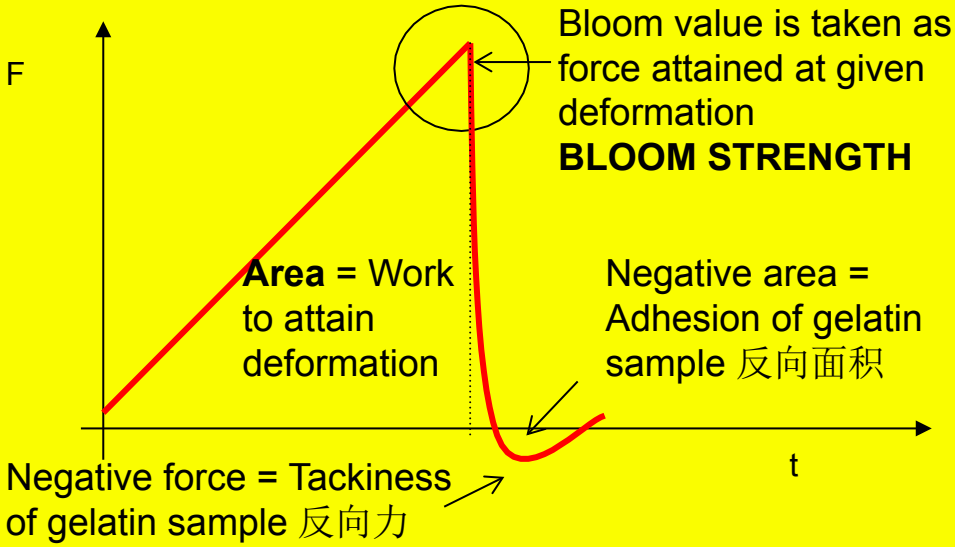
DOWNWARD FORCES向下施力

PUNCTURE AND PENETRATION: Probe comes into contact with surface creating both compressive and shear forces as penetration increases.

穿透试验：探头向下接触样品表面，当穿透力度加大时产生压力和剪切力



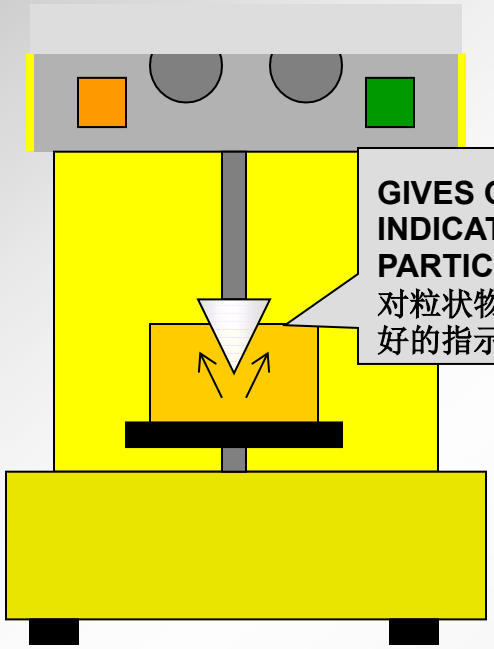
GELATIN BLOOM TEST 凝胶试验

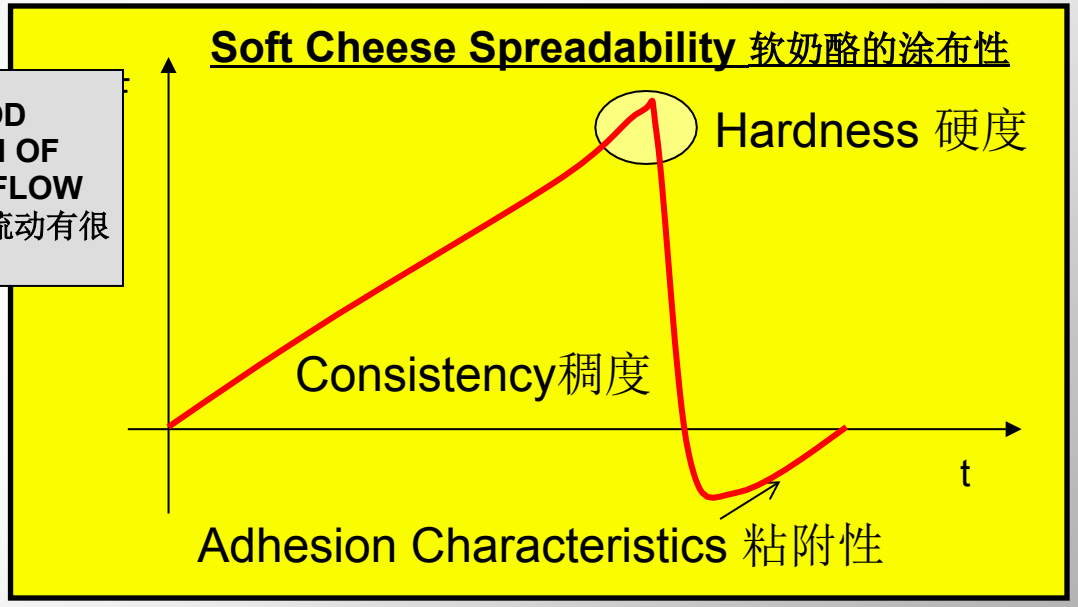


VARIABLE: PROBE TYPE 探针型号

DOWNWARD FORCES向下施力

PUNCTURE AND PENETRATION: Conical probe comes into contact with surface generating increased forces with increased contact areas as test proceeds.圆锥形探头与样品表面接触不断增加接触面积



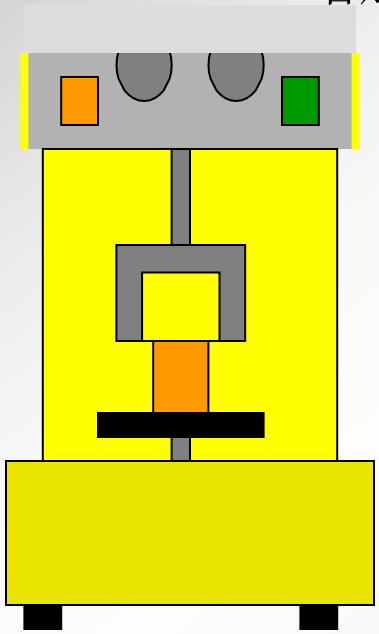


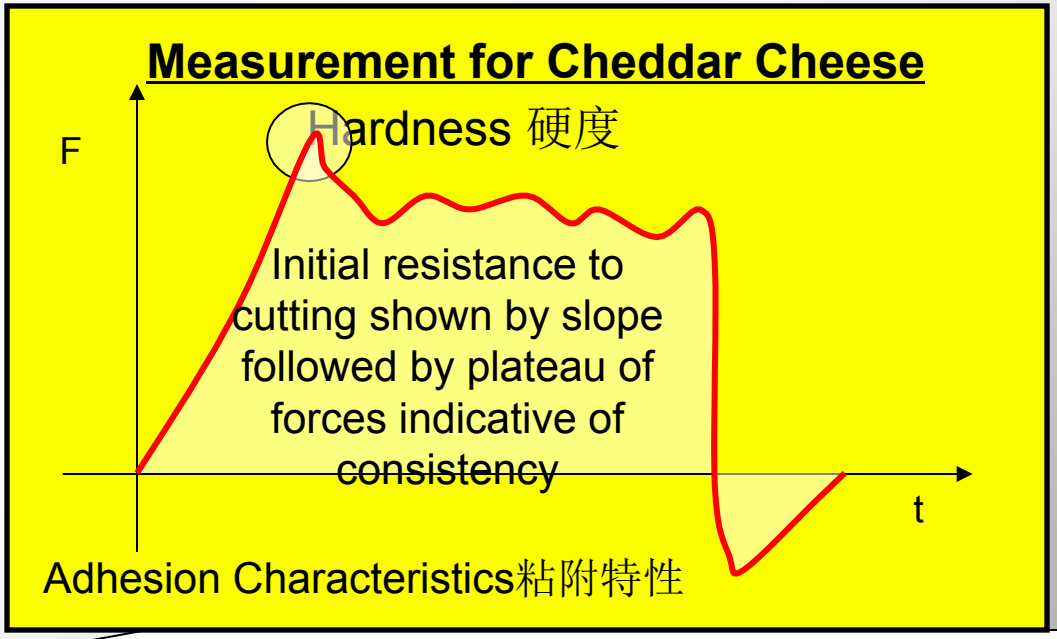
VARIABLE: PROBE TYPE 探针型号

DOWNWARD FORCES向下施力

CUTTING AND SHEARING: As the blade or cutting wire comes into contact with the samples cutting forces are generated as probe distance increases.

切割和剪切：刀片或切割线往下接触样品，当探针的距离增加时，产生切割力。



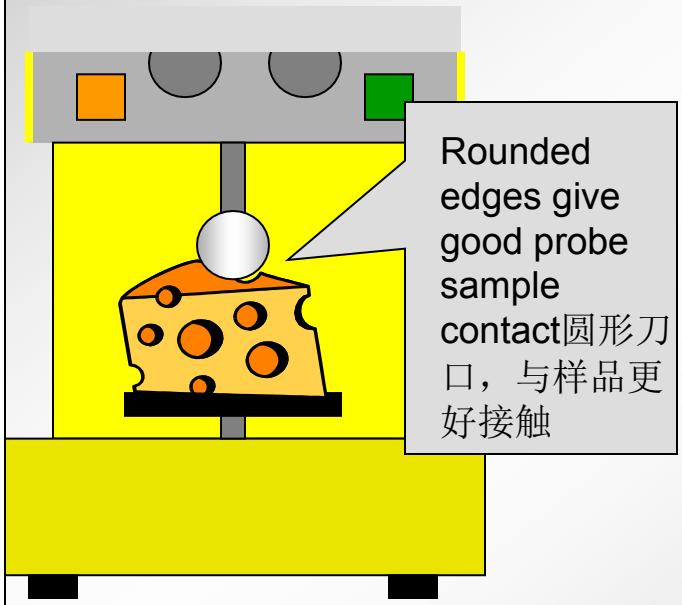


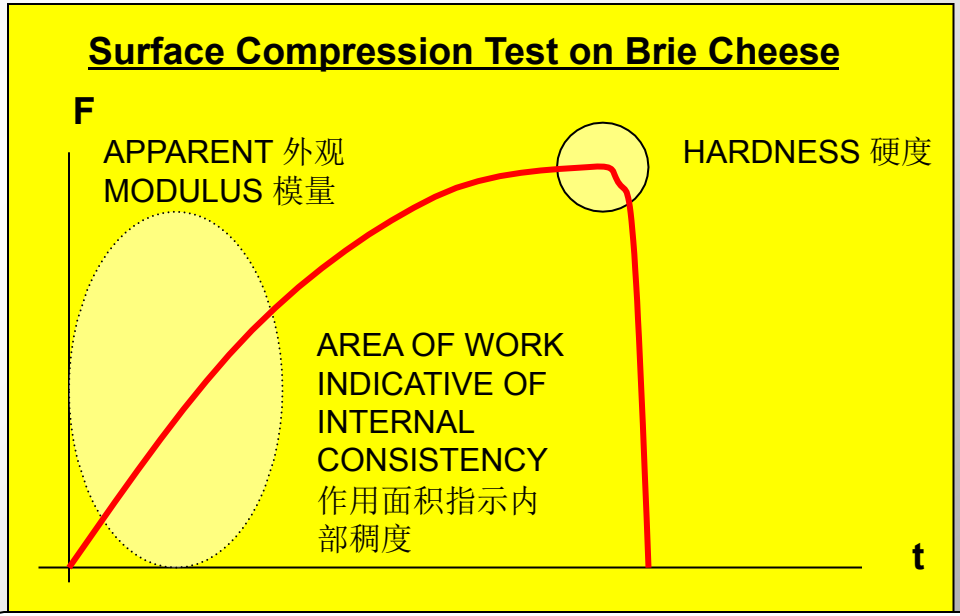
VARIABLE: PROBE TYPE 探针型号

DOWNWARD FORCES向下施力

SPHERICAL PROBES: Compression using rounded spherical ball probe. Probe comes into contact with surface creating predominantly compression forces until point of rupture or end of test.

球形探针：向下接触物体不断产生压力，直到样品接触点破裂或结束试验。

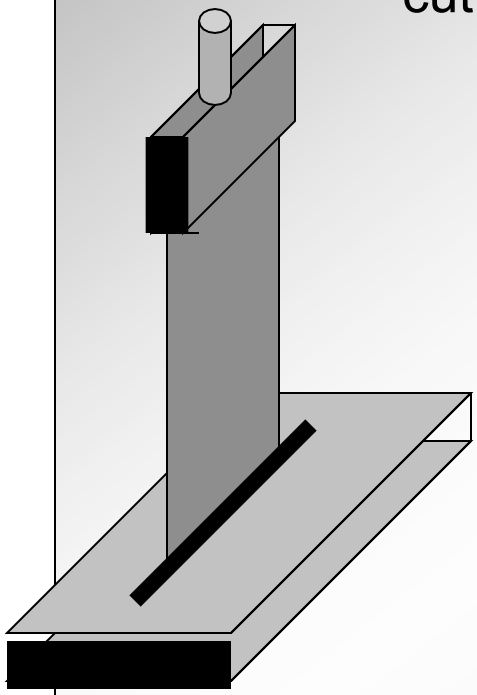




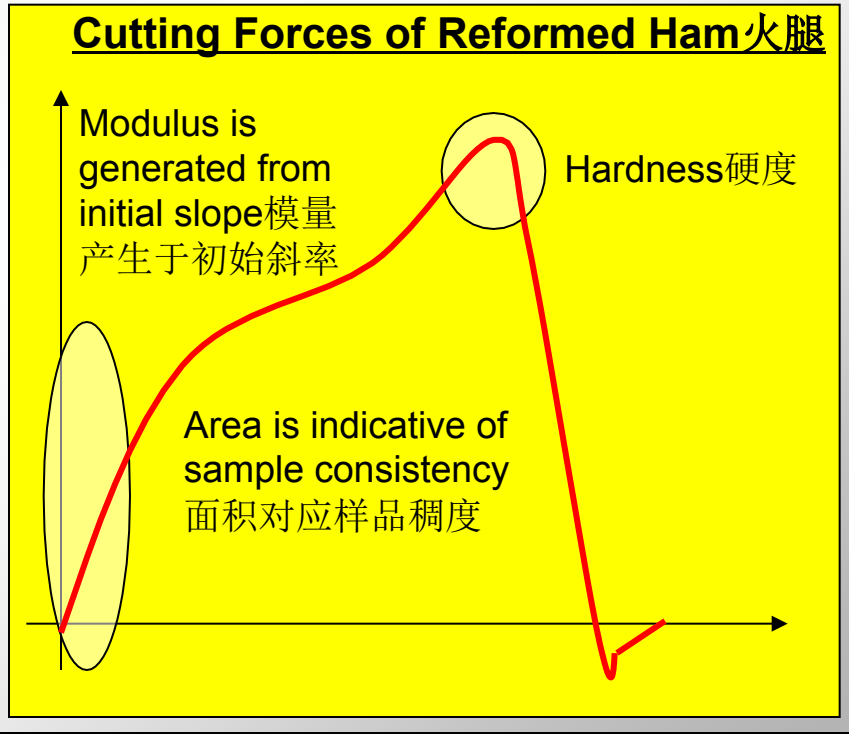
VARIABLE: TEST ACCESSORIES 附件

DOWNWARD FORCES 向下施力

CUTTING WITH A SHEAR BLADE: Blade fixtures are used to simulate the action of slicing or cutting. 用刀片切割：刀片夹具模拟切割行为。



- **Meat & meat products 肉类**
- **Fish 鱼**
- **Vegetables 蔬菜**
- **Cheeses奶酪**
- **Cosmetics 化妆品**

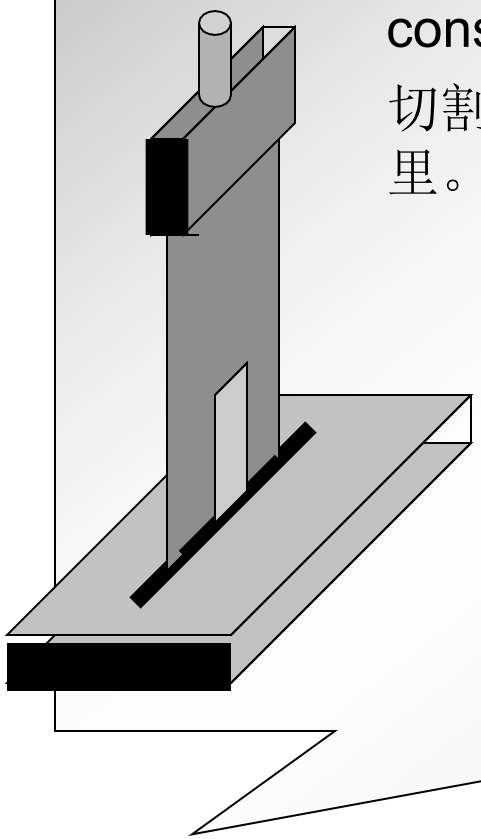


VARIABLE: TEST ACCESSORIES 附件

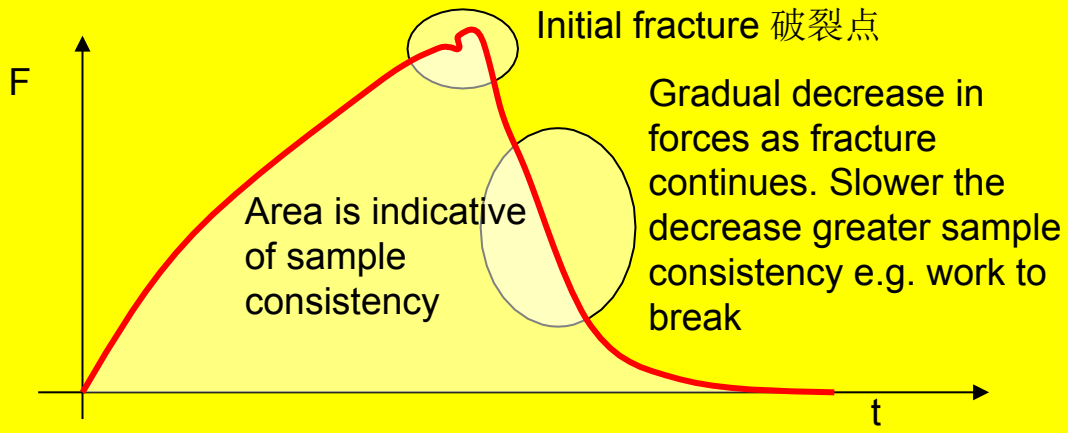
DOWNWARD FORCES 向下施力

CUTTING WITH A WARNER-BRATZLER BLADE: A notched blade centrally locates cylindrical samples such as sausages. The notched shape gives increased contact area throughout the test generating more constant results.

切割实验：将圆筒状的样品如香肠放在一个带凹口的刀片里。刀片的接触面积增加，试验结果为一个常数。



Warner-Bratzler Cut of a Sausage 香肠切割



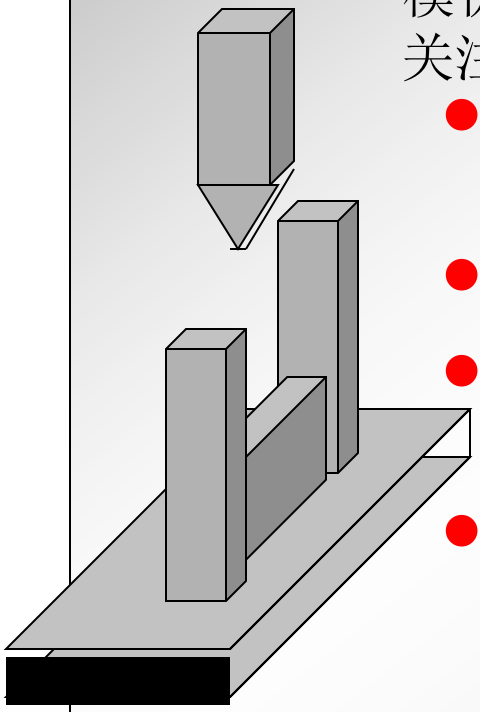
VARIABLE: TEST ACCESSORIES 附件

DOWNWARD FORCES 向下施力

CUTTING WITH VOLODKEVICH BITE JAWS:

Used to simulate the biting action with the front incisors. Peak force generated is of key interest.

模仿（人的）前面门牙撕咬的行为。产生的最大力是我们关注的重点。



- **Cereals 谷类食品**
- **Meats 肉类**
- **Fruits and 水果 vegetables蔬菜**
- **Confectionery 糖果**