



Lesson Plan: Cutting Tools Wearing

Grade level: University level

Duration: 2 hours

Objective: Students will learn about the different types of wear that occur in machining operations.

Materials needed:

- Used cutting inserts with visible wear.
- Video measurement system for wear identification and measurement.

Preparation:

1. The reasons for the occurrence of cutting tool wear are presented.
2. The types of wear that can occur are presented.
3. The wear mechanisms are explained.
4. The criteria used for quantitative wear are presented.
5. The Sinowon type video measurement system is presented.
6. The method of measuring dimensions in the xOy plane and along the z-axis direction is explained.
7. The wear on the seating face of a cutting insert is measured (v_B criterion).
8. The position (K_S) and depth (K_T) of the crater on the clearance face of the cutting insert are measured.
9. The wear criterion K is calculated, using the formula $K = K_T / K_S$.

Lesson Procedure

Introduction (50 minutes):

1. **Introduction:** Students are introduced to theoretical concepts related to cutting tool wear.
2. **Objective:** Understanding the concepts related to cutting tool wear.

Activity steps (40 minutes):

1. Preparation (10 minutes):

- The Sinowon 3D video measurement system is introduced.
- A worn cutting insert is selected.
- The wear on the clearance face and the seating face of the insert is introduced to the students.



2. Measurement of wear on the rake face (10 minutes):

- **Step 1:** Position the plate on the machine table so that the wear on the rake face is visible.
- **Step 2:** Focus on the image on the existing wear.
- **Step 3:** Measure the size of the wear.

3. Measurement of wear on the relief face (20 minutes):

- **Step 1:** Position the insert with the clearance face up.
- **Step 2:** Measure the distance from the center of the crater to the cutting edge of the tool.
- **Step 3:** Measure the depth of the crater.
- **Step 4:** Calculate the wear criterion K.

4. Conclusion (10 minutes):

1. **Showcase:** Discussions on how to assess wear.
2. **Reflection:** Possibilities for reducing cutting tool wear.

Assessment:

- **Participation:** Observe students' participation in the activity and their ability to follow instructions.
- **Completion:** Each student performed the measurement steps correctly.

To encourage students to think critically about the STEM fields involved, you could ask:

Which STEM fields do you think were used in cutting tools wearing, and how did each field play a role?

This question helps them recognize:

1. **Science** – Understanding material properties of machined parts.
2. **Technology** – Using computer-assisted measuring machines.
3. **Engineering** – Thinking about the machining process.
4. **Math** – Measuring dimensions and planning layout for measurements.