



COVET

**Continuing Professional
Development
in Vocational Education
and Training**

Tool Materials

Inspiration for online teaching



In the COVET project, we have collected many great examples of teaching that have been transformed from the classic off-line version into a modern online learning method.

These sample lessons have been created by VET teachers from different EU countries. We present them to you as inspiration for your work.

The lessons are particularly suitable for vocational teachers, but can also serve as a training tool for teachers, trainers and lecturers in other educational settings.

All sample lessons, training materials as well as all information about the project are available at:

<https://www.covet-project.eu/>

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Tool Materials

1st year of a two-year post-apprenticeship Operational Technology course

Off-line version of the preparation

Goal

Students can use the correct names of basic tool materials and can name these materials. They will review the names and properties of machined materials. They will be able to explain the relationship between the properties of machined and machining materials.

They can compare individual machining materials with each other using their basic properties: chemical stability at high temperatures, bending strength and hardness.

They can explain which cutting materials are most commonly used for a particular material to be machined. Can explain which materials are most commonly used, e.g. to maintain high quality finishing operations, etc.

Teaching methods

explanation, problem-based interview, examples of corresponding photographs in PPT presentation, other methods according to the classroom situation

Aids

Samples of several types of cutting inserts

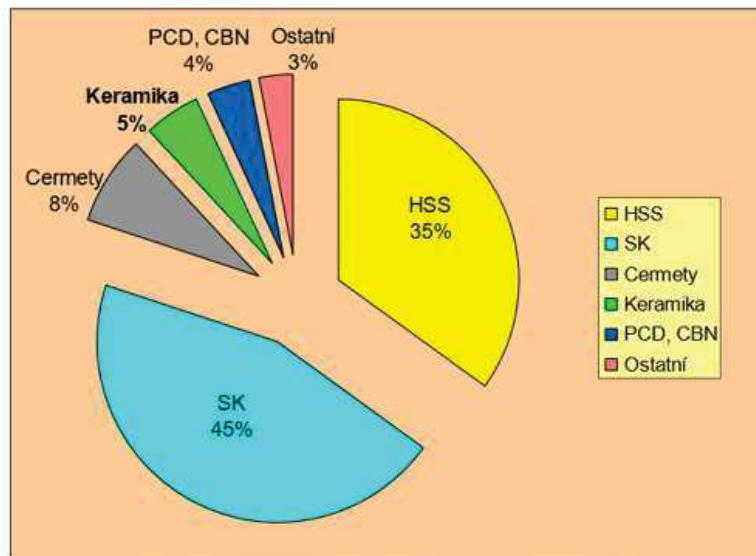
Presentation: charts on properties and frequency of use of cutting materials; photos of cutting inserts made of different materials; division of basic cutting material into further subgroups; detailed composition and production of some tool materials; marking of materials according to ISO...

Teaching texts summarising the material taught. They will be given out after the lesson.

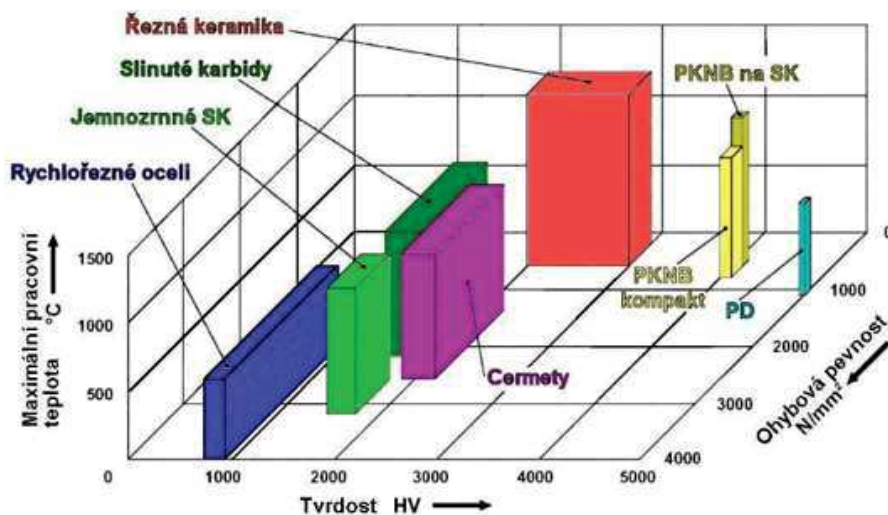
The course of activities in the lesson

- Repetition of cutability
- Repetition of names and basic properties of machined materials
- By discussion we will find out what properties the cutting - tool material must have in comparison to the machined material
- Using graphs to compare the properties of tool materials
- Deduction of which tool material is suitable for which machined material
- Comparison of sintered carbides and cermets; the features they have in common; how they differ; their production and use
- Distribution of worksheets
- Evaluation of the lesson

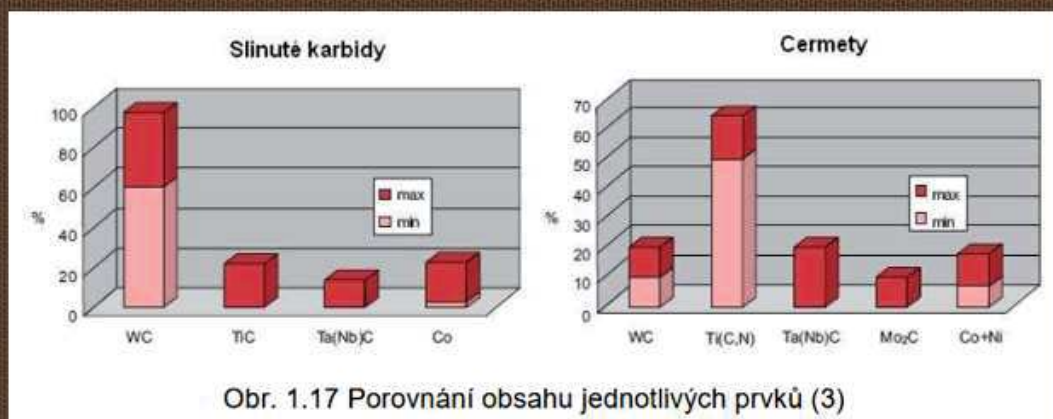
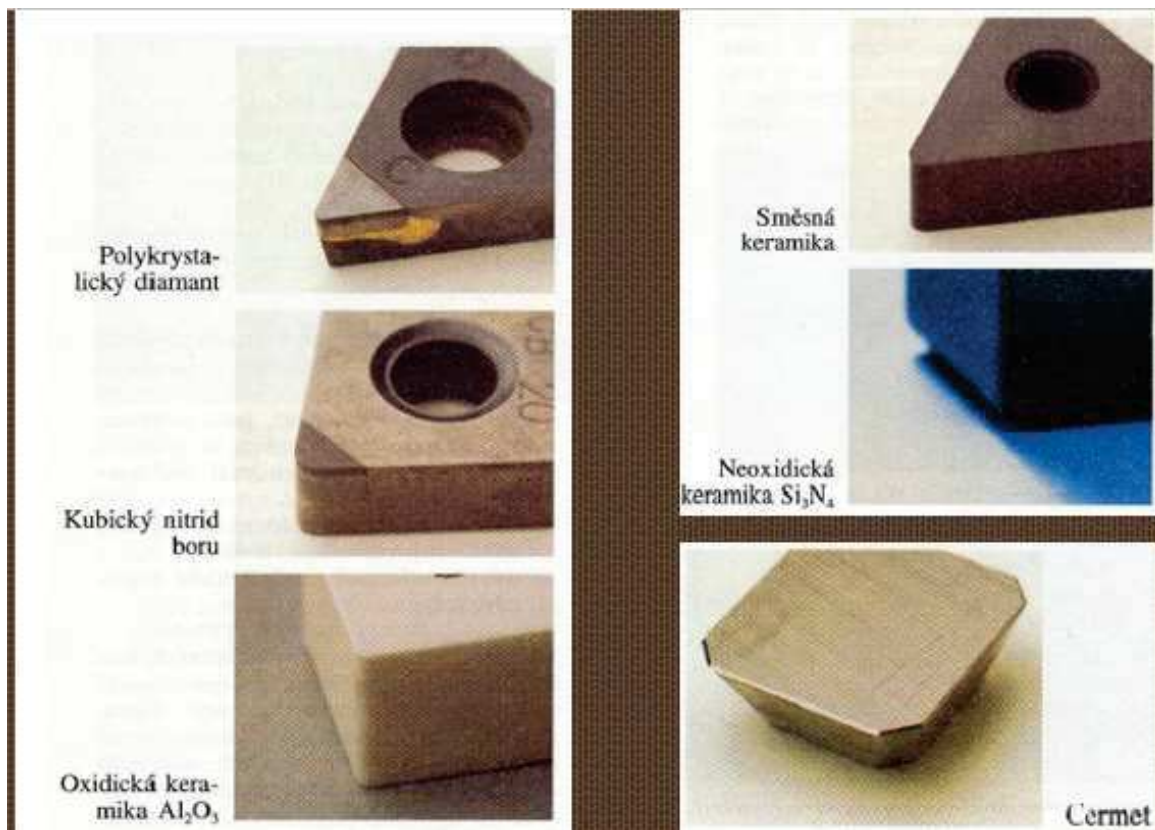
A sample of several slides from the PPT presentation:



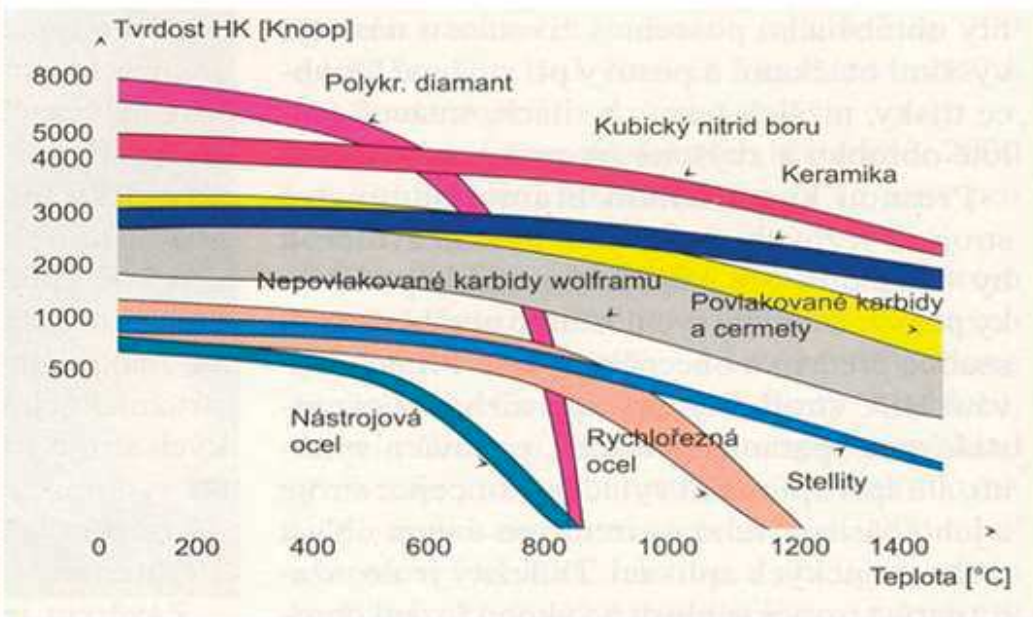
Obr. 1.9 Světové využití nástrojových materiálů ²⁶



Obr. 1.18 Vlastnosti jednotlivých řezných materiálů (28)



Pokles tvrdosti řezných materiálů s teplotou



SLINUTÉ KARBIDY

Skupina	Podskupina	Základní chemické složení	Efektivní aplikace pro obráběný materiál
P	P01, P05, P10, P15, P20, P25, P30, P35, P40, P45, P50	WC (30÷82)% + TiC (8÷64)% + Co (5÷17)% + (TaC.NbC)	Slinuté karbidy pro obrábění materiálů, dávající dlouhou, plynulou třísku: nelegovaná, nízkolegovaná a vysoce legovaná ocel, litá ocel, automatová ocel, nástrojová ocel, feritická a martenzitická korozivzdorná ocel.
M	M01, M05, M10, M15, M20, M25, M30, M35	WC (79÷84)% + TiC (5÷10)% + TaC.NbC (4÷7)% + Co (6÷15)%	Slinuté karbidy pro obrábění materiálů, dávající dlouhou a střední třísku: austenitická a feriticko austenitická ocel, korozivzdorná, žáruvzdorná, žárovevná, nemagnetická a otěruvzdorná ocel.
K	K01, K05, K10, K15, K20, K25, K30, K35, K40	WC (87÷92)% + Co (4÷12)% + (TaC.NbC)	Slinuté karbidy pro obrábění materiálů, dávající krátkou, drobnou třísku: nelegovaná i legovaná šedá litina, tvárná litina, temperovaná litina
N	N01, N05, N10, N15, N20, N25, N30		Slinuté karbidy pro obrábění neželezných materiálů: slitiny mědi a hliníku, duroplasty, fibry, plasty s vlákninou, tvrdá guma.
S	S01, S05, S10, S15, S20, S25, S30		Slinuté karbidy pro obrábění: žáruvzdorné slitiny na bázi Fe, superslitiny na bázi Ni nebo Co, Titanu, Ti slitiny
H	H01, H05, H10, H15, H20, H25, H30		Slinuté karbidy pro obrábění: zušlechťené oceli s pevností nad 1500 Mpa, kalené oceli HRC 48÷60, tvrzené kokilové litiny HSh 55÷58

Online version of the preparation

In the first year, students in the post-secondary study following the three-year apprenticeship course usually have the idea that they don't have to learn much and graduation "comes" like the apprenticeship certificate "came" before. Up to now, they have mostly learned everything by heart or have memorised technical things in repetitive manual vocational work in practical classes. The more theoretical questions in the final exams were a stumbling block. Now they do not have practical classes and have to add theoretical analysis of the knowledge to their previous knowledge. They are usually not able to make connections between the individual pieces of knowledge and derive solutions from the information given or found. They learn in such a way, in their words, that they look at the text summarising the material over and over again for an hour and learn it by memorising. Very often they do not know how to ask questions and look for connections in order to understand and anchor the material. But what they always have to **start with is to label or list the CONCEPTS** they don't understand exactly or whose names they can't use. **Learn these concepts - understand them and, by repeating them in different connections, learn them. Then they must understand the matter taught, and finally learn to explain it in the spoken word – explaining it with their own phrasing, but expressing correctly the meaning of the matter taught.** I require and repeat these activities for them during their school lessons. However, the motivation to work in class is often lacking for many.

Learning the correct concepts makes it very difficult for the students and thus they fail to learn the technical material right from the beginning and have no choice but to learn the material without any sense by heart. It is not **the intellect that makes it difficult for them**, but more likely they refuse to study and learn due to their previous learning experience at school. Very often they were not made to understand at school, but more likely just learn by heart. But this post-secondary studying requires different skills and understanding.

In order to make them realise that it is not only me as a teacher who wants them to understand **concepts and precise language**, but that this is **common in professional companies**, I included in the lesson a search for information in companies that produce tooling materials. This way of gaining knowledge is also **more motivating** for many students (**independence, activity**).

In this lesson, they search for basic information about materials in a company's online catalogue. At the end, students write out any new or unclear technical terms. **The concepts are then clarified.**

In the following two sessions, they look for more detailed information to solve a specific machining problem with specific requirements for the machined area. They seek this information from two manufacturers of similar tool materials. They then **work in teams to produce an advertisement for one type of tipped cutting tool produced by the respective company.**

What I had to prepare for class

- Create a worksheet based on a study of the Sandvik website
- Send students a link to the website in Teams
- Prepare a brief explanation in PPT on how to search for **credible expert information**
- **This entire activity can also be done fully online by sending the worksheet in pdf.**

PPT slide with a link to list of materials





NÁSTROJOVÉ MATERIÁLY

vyhledávání na Internetu

pracovní list – založte mezi výukové listy

Odpovědi neopisujte v celé délce firemního textu, text zestručněte na základní pojmy a základní vlastnosti.

1) Na internetových stránkách firmy Sandvik Coromant <https://www.sandvik.coromant.com/cs-cz/knowledge/materials/cutting-tool-materials?fbclid=IwAR3JbZ9Yt1LB388O2v-O47VhjW63Zoa68DqRTNptAwEE5Somp8vLGLXzFv6>



- 1) Ověřte, zda vyrábí základní řezné materiály, které znáte. Všechny názvy materiálů, ze kterých Sandvik vyrábí svoje nástroje (VBD) vyplšte zde:

.....

- 2) Najděte, jaké vlastnosti musí mít nástrojový materiál obecně?

- ✓
- ✓
- ✓
- ✓
- ✓

- 3) Jaké mají výhody povlakované VBD z SK?

.....

- 4) Z čeho se skládá slitinový karbid?

.....

- 5) Jaký vliv má na vlastnosti VBD velikost zrna WC a kterou vlastnost určuje především obsah Co jako pojiva?

.....

.....

- 6) Co je to gradientní SK, jaké má vlastnosti?

.....

.....

- 7) Jaké je složení cermetů? K jakým obráběcím operacím cermety firma Sandvik doporučuje?

.....

.....

.....

- 8) Jaké druhy řezné keramiky v Sandvik Coromant používají? K jakým obráběcím operacím RK firma Sandvik doporučuje?

.....

.....

.....

9) Jaké vlastnosti má polykrystalický diamant? K jakým obráběcím operacím PD firma Sandvik doporučuje?

10) Pro jaké operace obrábění nabízí Sandvik svoje nástrojové třídy a břitové destičky?

11) O jaký materiál, jehož struktura je zvětšená na následující fotografii, se jedná?



12) Z jakého materiálu je roubík upevněný na VBD z SK? K jakým obráběcím operacím jej Sandvik doporučuje používat?



ZDE VYPIŠTE VŠECHNY PRO VÁS NOVÉ NEBO NEÚPLNĚ JASNÉ ODBORNÉ POJMY:

The course of teaching has therefore changed as follows

- Repetition of cutability and machinability
- Search for information **using mobile phones online on the Sandvik website**, on the **link they received from the teacher through Teams**, they can also work in pairs
- **Checking the accuracy** of the information found - discussion
- Discussion and explanation of technical terms related to tooling materials and their applications that have been used on the Sandvik website, students talk about the subject in their own words while consistently using technical terms
- Distribution of teaching sheets
- Evaluation of the lesson

Feedback on the lesson

Although this is not a typical online lesson, this was an important step to get my students online for professional reasons. This attempts to make them use critical thinking and analyse obtained information. Moving most of the studying and research online made it more practical for the students. It moved the lesson closer to a real-life experience. They are very likely to utilise this skill in their working life.

It is quite difficult to prepare and check everything in advance for the teacher, but it provides a great teaching online “library” for any future use. This proved to me that one does not have to use online elements “just for the sake of it”, but involving an online element can completely change the atmosphere.



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