

# Posudek práce

předložené na Matematicko-fyzikální fakultě  
Univerzity Karlovy

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|---|---|
| <input checked="" type="checkbox"/> posudek vedoucího | <input type="checkbox"/> posudek oponenta |
| <input checked="" type="checkbox"/> bakalářské práce  | <input type="checkbox"/> diplomové práce  |

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Název práce: Bachelor Student  
Studijní program a obor: General Physics [FOF]  
Rok odevzdání: 2019-2020

Jméno a tituly vedoucího/opponenta: Ross Harvey Colman, Dr.  
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## Odborná úroveň práce:

- vynikající  velmi dobrá  průměrná  podprůměrná  nevyhovující

## Věcné chyby:

- téměř žádné  vzhledem k rozsahu přiměřený počet  méně podstatné četné  závažné

## Výsledky:

- originální  původní i převzaté  netriviální kompilace  citované z literatury  opsané

## Rozsah práce:

- veliký  standardní  dostatečný  nedostatečný

## Grafická, jazyková a formální úroveň:

- vynikající  velmi dobrá  průměrná  podprůměrná  nevyhovující

## Tiskové chyby:

- téměř žádné  vzhledem k rozsahu a tématu přiměřený počet  četné

## Celková úroveň práce:

- vynikající  velmi dobrá  průměrná  podprůměrná  nevyhovující

### **Slovní vyjádření, komentáře a připomínky vedoucího/ponenta:**

The presented work is of an experimental nature. The student focused on the growth of a series of single crystal Ni-Mn-Ga alloys, with selective composition co-substitution of Cu and Fe, based on a recent literature article that indicated an interesting composition region. The student performed a number of tasks relating to the initial alloying, single crystal growth and finally characterisation of a total of 5 samples during his bachelors project. The synthesis involved alloying by arc melting and casting, followed single crystal growth by a modified optical floating zone method using a single crystal seed. The prepared single crystals were then checked by Laue diffraction, by powder diffraction, by EDX/XRF composition analysis, and finally by magnetometry.

The student listened well during introductions to the equipment and despite complexity was able to perform almost all tasks independently by the last sample. He analysed all composition and magnetometry data by himself, and performed initial analysis of powder diffraction data although he did not perform the Rietveld refinements independently.

The thesis consists of a first chapter dedicated to the theory and background of magnetic shape memory materials. It provides a thorough review of the relevant literature, including 30 references that are well selected and appear to be included in the bibliography with reasonable and consistent formatting. The student uses this introduction to build up a history of shape memory materials, before describing the magnetic shape memory effect, its key characteristics and the material family that displays it. He then goes on to show the effects of doping, and finally sets up the goals of this project well: the preparation of a series of doped Ni-Mn-Ga alloys.

The second chapter describes the basic theory behind each technique used for preparation and characterisation during the project.

The third chapter describes material preparation, giving specific details for each step in the manufacture of the polycrystalline precursors, the growth of the single crystals, and the preparation of the products for measurements of magnetisation and powder diffraction. The descriptions presented within this chapter seem nicely complete, with good discussion about the reasons for the chosen parameters (such as growth speed, or atmosphere).

The fourth chapter describes the characterisation results. Whilst a specific composition range was justified as the target of the project, it is immediately clear that the grown crystals ended up with compositions some way from the intended targets. The student does try to discuss possibilities for the reasons behind obtaining the varied compositions. The student then goes on to extract key parameters from the collected magnetisation data, such as Curie temperature, martensitic transformation temperatures, and pre- or inter-martensitic transformation temperatures. The composition variation from the target values makes interpreting the collected data in a framework with the previously published results difficult, however a reasonable attempt at comparing variations in some of these parameters with composition are made.

Throughout the whole document, a total of 45 references are made, primarily to peer review articles.

The figures and tables throughout the thesis are presented well. Care has been taken to ensure the figures clearly show the key information with suitable keys and captions.

The work is written in English with a level surpassing expectations. Very few typos or grammatical errors are evident in the text.

### Případné otázky při obhajobě a náměty do diskuze:

- Can you discuss the reasons for specifically choosing the optical floating zone growth technique for these materials, and its benefits over other growth methods (e.g. Bridgman or Czochralski)?
- Can you comment on the specific difficulties associated with growing alloys that contain manganese?
- The magnetic data is only one small piece of sample – do you expect this to be representative of the whole crystal?
- Can you expand on the material limitations that must be overcome before these alloys will become accepted as useful/interesting for industrial applications?
- What industrial applications can you envisage these materials being useful for, if these material limitations are overcome?

### Práci

doporučuji

nedoporučuji

uznat jako diplomovou/bakalářskou.

### Navrhuji hodnocení stupněm:

výborně  velmi dobře  dobře  neprospěl/a

Místo, datum a podpis ~~vedoucího/opponenta~~:

15.06.20

Ross Colman

