ORBITS AS CONIC SECTIONS SHOWING THAT A DISTANCE SQUARED LAW GIVES AN ELLIPTICAL ORBIT

by

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DEPARTMENT APPROVAL

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ABSTRACT

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The abstract is a *summary* of the thesis, *not an introduction*. Keep in mind that abstracts are often published separately from the paper they summarize. In your abstract, give a concise synopsis of the work, emphasizing the conclusions; you need not include the supporting arguments for the conclusions. The purpose of the abstract is to help prospective readers decide whether to read your thesis, but your goal is not necessarily to persuade people to read your thesis. In fact, a successful abstract enables people to get an accurate overall view of your work without needing to read it. Usually, an abstract contains a single paragraph, but it can have more if absolutely necessary. Remember to state the subject of the paper immediately followed by a summary of the experimental or theoretical results and the methods used to obtain them. Avoid equations, graphics, and citations; if a citation is essential it must be cited fully

within the abstract. Keep the abstract factual. Avoid vague statements like, “Conclusions are drawn,” or “the significance of the experiment is discussed.” State the conclusions and findings outright in the abstract.

ACKNOWLEDGMENTS

This page is optional. You may acknowledge whom you will—your advisor, colleagues, family members. Please keep acknowledgments in good taste. I would like to acknowledge Dr. Kristine Hansen and Dr. Elizabeth Hedengren, whose Advanced Writing Seminar motivated this project. I also wish to thank Jean-François Van Huele, Steven Turley, and Ross Spencer for reviewing this document and for ripping it to shreds as every good advisor should do to a thesis draft.

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Chapter 1

Background

Chapter 2

Methods

Three different methods for determining relative percentages of the dopant in the substrate are used. The methods are: 1. Take the ratio of the max peak intensity, 2. Fit the peaks to a Gaussian curve, and find the integrated area, 3. Perform a summation to find the numerical integral. These methods are predicated on certain assumptions. The mixture of the probed depth is uniform, which is a known simplification of how the diffused dopants actually spread (an analysis to correct this has been tried, but better data is needed for it to be effective). The intensity of the x-ray is also assumed to have attenuated by 90%, and all relevant data comes from that. The last assumption is that the sample is put in its perferred orientation for the silicon structure to be alined with the x-ray beam. The index of refration is the same as bulk samples[1].

Method 1: Ratio

With this method the program takes the max intensity of the amorphous hump, and the max intensity of the most intense crystalline peak, and takes the ratio of them. This ratio is then the relative percentages of the dopant and substrate[2].

Method 2: Curve Fitting

This method takes the position and intensity values as the x and y inputs of scipy's curve_fit function. It then outputs the best fit for amplitude, mean, standard deviation, and a background value. The function then gets integrated, and the ratio of the areas are taken.

Method 3: Summation

This is an integral method as in method 2, but instead of fitting the data to a curve the data is integrated using discrete methods. The dx is the same for all points, so it is ignored with the foresight that it will be divided out. The sum is of all the intensity values for the peak or hump. A ratio is then taken from these sums.

Chapter 3

Results

Chapter 4

Analysis

Chapter 5

Conclusion

5.1 Future Work

Bibliography

[1] P. Colombi, P. Zanola, E. Bontempi, and L. E. Depero, "Modeling of glancing incidence X-ray for depth profiling of thin layers," Spectrochimica Acta Part B: Atomic Spectroscopy **62,** 554–557 (2007), a Collection of Papers Presented at the 18th International Congress on X-Ray Optics and Microanalysis (ICXOM 2005).

[2] A. Pandey, S. Dalal, S. Dutta, and A. Dixit, "Structural characterization of polycrystalline thin films by X-ray diffraction techniques," Journal of Materials Science: Materials in Electronics **32,** 1341–1368 (2021).

Appendix A

XRD Manual

The purpose of an appendix is to provide supplementary information which would distract if included in the main body of the thesis. Items appearing as an appendix might include lengthy derivations. If students feel compelled to include a brief tutorial on relevant background information (not new research), it should appear as an appendix. An appendix might consist of portions of unique computer code that was developed as part of the project.