DT-FOF-07-2020
Assembly of micro parts (RIA)

TINKER

FABRICATION OF SENSOR PACKAGES ENABLED BY ADDITIVE MANUFACTURING

Starting date of the project: 01/10/2020
Duration: 36 months

= Deliverable D4.4 =

Data set in repository

Due date of deliverable: 31/12/2023
Actual submission date: 29/12/2023

Responsible WP: Abdalla Shahin, WP4, PRO
Revision: V1.1

Dissemination level		
PU	Public	X
PP	Restricted to other programme participants (including the Commission Services)	
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CO	Confidential, only for members of the consortium (including the Commission Services)	

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DOCUMENT CONTROL

Document version	Date	Change
V1.0	13.12.2023	Template draft created
V1.0	19.12.2023	Input compiled and reviewed by WP leader
V1.1	29.12.2023	Review and finalization by CO

VALIDATION

Reviewers		Validation date
Work Package Leader	Abdalla Shahin	20.12.2023
Coordinator	Pavel Kulha (PRO)	29.12.2023

DOCUMENT DATA

Keywords	Data set, repository
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Delivery date	29.12.2023

Executive Summary

Within this deliverable the subset of TINKER data in the public repository is described with respect to the data management plan DMP presented in D1.1.

For the purpose of supporting the project and sharing the outcomes of TINKER, a public repository is created based on Zenodo cloud platform. The TINKER data is stored on Zenodo in order to fully understand and reproduce the research efforts within the project.

An overview of each data record is presented as well as their utility within the project. Moreover, the title of each data record and the identifier given by Zenodo are both unique to make every data entry findable and easily accessible.

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1. Introduction

The vision of TINKER is to provide a new cost- effective and resource-efficient pathway for RADAR and LiDAR sensor package fabrication with high throughput up to 250units/min, improved automation by 20%, improved accuracy by 50% and reliability by a factor of 100 to the European automotive and microelectronic industry via additive manufacturing and inline feedback control mechanisms. Autonomous driving and self-driving cars represent one prominent example for the use of microelectronics and sensor, most importantly RADAR and LiDAR sensors. Their respective markets have a big potential, e.g. it is estimated that the market size of LiDAR in automotive will double itself in the next two years (within 2020 to 2022).

Figure 1: TINKER overview

The public awareness and the industrial need for further miniaturization of such sensor packages is the main driver of ongoing efforts in the automotive sector to be able to integrate such devices into the car body like in the bumpers and head lamps instead of attaching them (e.g. on top of the car in case of LiDAR device). Safety (for the driver and others) is the most important key aspect of the automotive sector. Therefore, high-value and high-performance RADAR and LiDAR systems are required for advanced driver-assistance systems (ADAS) as well as robotic cars. Current bottlenecks are the relatively large size of such sensor devices, their weight and power consumption. Since these factors are highly limited within cars, further miniaturization and improving functionality and efficient use of resources is highly demanded.

1.1. Description of deliverable

Deliverable D4.4 “Data set in repository” relates to Task 4.4 in work package 4 “Feedback Control”. This Deliverable focuses mainly on the description of TINKER dataset in the public repository based on Zenodo.

2. Repository and Data Set Description

In this section, the open access dataset of TINKER is described. Zenodo will be the open platform of choice for TINKER, due to user friendliness and good acceptance, once the data is released for being published. There, dedicated data are stored, using standardized naming and unique identifier. The following naming convention is used for all data records within Zenodo:

TINKER_WPx_<task/topic>_<date>_<continuous number>

<task/topic>: information on the purpose of the data, e.g. Cu-formulation, optical inspection, etc.

<date>: actual date, when the data was established

<continuous number>: numbering to distinguish between individual files per data set.

2.1. Zenodo Platform

Zenodo is a digital repository and open-access platform that facilitates the sharing, archiving, and dissemination of scholarly research outputs. Launched in 2013 by OpenAIRE and CERN, Zenodo provides a space for researchers to deposit a wide range of research outputs, including datasets, software, preprints, and other digital objects. One of its key features is its commitment to openness and interoperability, allowing contributors to assign Digital Object Identifiers (DOIs) to their uploads, ensuring long-term accessibility and citability. Zenodo serves as a collaborative and multidisciplinary platform, fostering global knowledge exchange and supporting the principles of open science.

The nature of Zenodo serves the purpose of TINKER in terms of dissemination and publication of the project results. The rationale is to open access of scientific publications; research integrity will be increased through transparency, impact will be greater through re-use, duplication of efforts will be reduced, and civil society will benefit from better value from its financial contribution. Zenodo also allows the user to add almost all types of metadata such as source of funding, where and when the data were collected.

There are four main aspects of open data summarised in the acronym FAIR which are all guaranteed by Zenodo:

- **Findable: data has a unique, persistent ID, located in a searchable resource, and documented with meaningful metadata**. Zenodo assigns a unique DOI for each data record to be found easily.

- **Accessible: data is readily and freely retrievable using common methods and protocols, metadata is accessible even if the data is not**. Zenodo ensures free access to the data and metadata such as viewing or downloading without efforts as shown in Figure 2.

- I**nteroperable: data is presented in broadly recognised standard formats, vocabularies, and languages.**

- **Re-useable: data has clear licences, and accurate meaningful metadata conformity to relevant community standards and identifying its content and provenance.** Zenodo ensures that each data record must have some metadata entered by the user to achieve interoperability and re-usability such as writing a description of the data, choosing a resource type from a drop-down list with the most common types, adding a meaningful and consistent title, and choosing the language used in case of text data, for instance. Moreover, Zenodo automatically assigns some metadata such as date of upload and DOI.

The TINKER Zenodo repository can be accessed using the link:

https://zenodo.org/communities/tinker

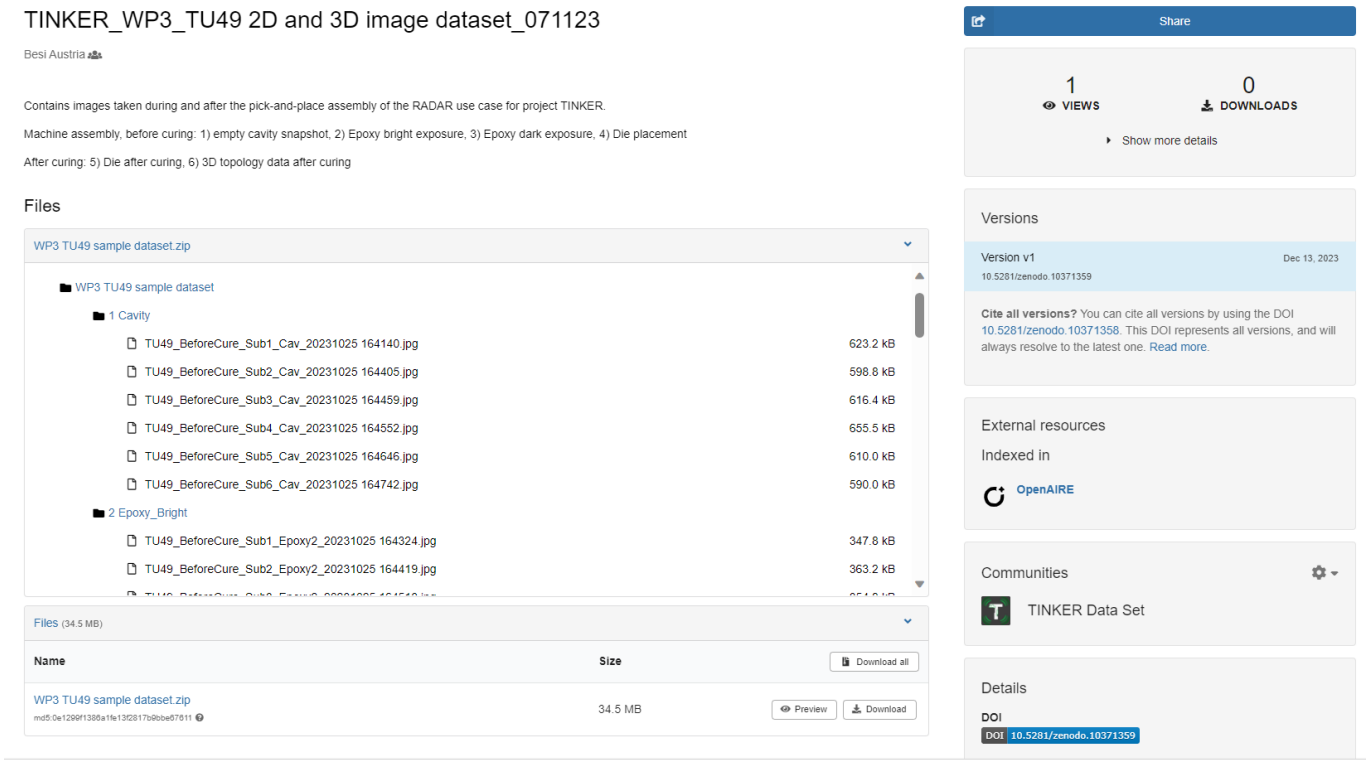

Figure 2: Data accessibility within Zenodo either by previewing or downloading the data. Metadata are also available to the user.

2.2. Data Records

The TINKER zenodo platform contains a subset of the dataset produced throughout the project from the different Work Packages (WPs). First of all, a subset of the assembly data was uploaded in multiple records. These records include images of the demonstrator parts (pre- and post-bond), and pre- and post-curing. Moreover, images and depth measurements of the gap are present. Second, a subset of the data generated as part of the feedback control is uploaded as well. It includes the gap filling data and the software codes for data processing, printing files generation, and machine learning algorithms. From additive manufacturing processes, much data was generated. The data on Zenodo corresponding to them includes ink development diagram from TIGER coatings, inkjet printing settings and parameters, characterization data samples of inkjet printing experiments, and NIL images acquired for NIL stamp inspection. All data records on the TINKER Zenodo repository have a concise description to ensure that the public can understand and reuse the data when needed. Figure 3 shows a preview of the main page of the repository as well as the data records and their naming conventions.

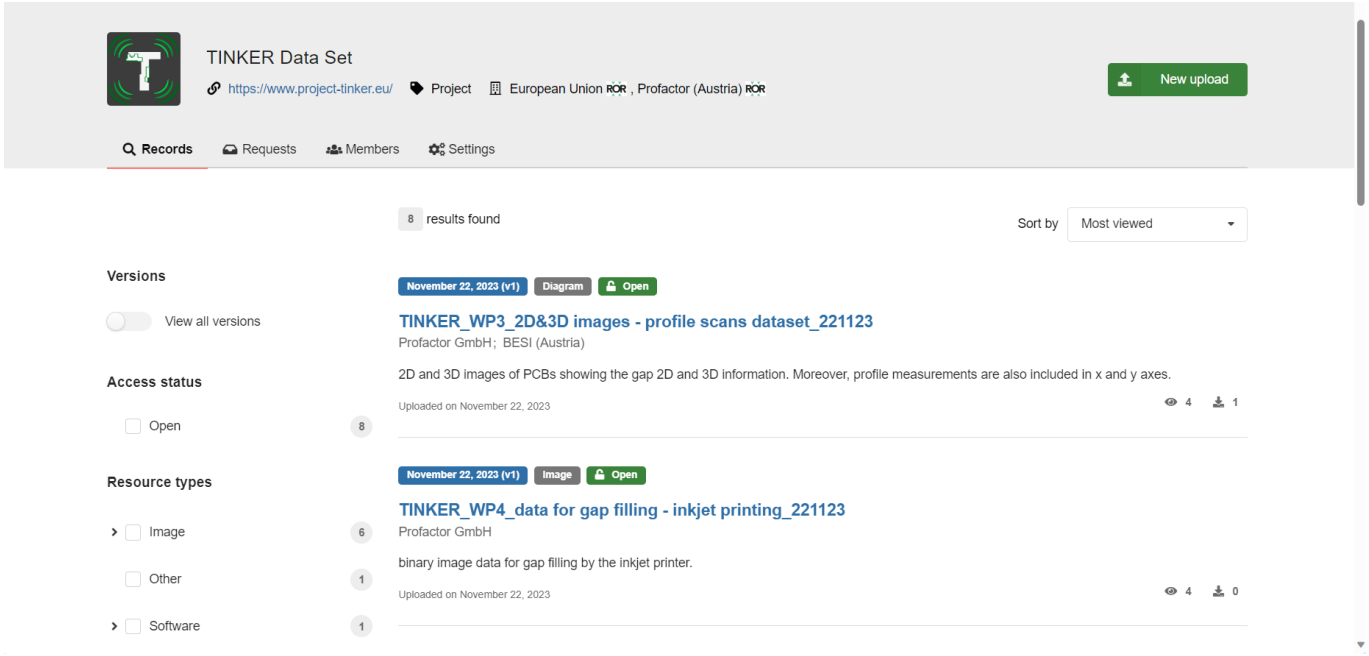

Figure 3: Preview of the main page of TINKER Zenodo repository and preview of the data records.

3. Summary and Outlook

To summarize, this deliverable is a documentation of a subset of the data produced within TINKER. The data is made public by means of a free and open access platform named Zenodo. The aim of using Zenodo is to make the data findable and accessible by the user, interoperable and re-usable since Zenodo assigns a unique DOI for each data entry and allows the user to enter some mandatory metadata to fully define and describe the uploaded dataset. The Zenodo repository of TINKER contains data from the different WPs such as the assembly data, the feedback control data, data from the additive manufacturing processes, and characterization data. However, some more data will be uploaded in the near future such as design analysis data of the final use cases and new image data of the NIL stamp inspection.